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THE AMERICAN GAS LIGHT JOURNAL

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

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[Special Editorial Correspondence.]

THE COMING-OF-AGE MEETING OF THE AMERICAN GAS LIGHT ASSOCIATION.

CHICAGO, October 18th, 1893.

Dear JOURNAL: It is pretty generally conceded that all things come to those who wait, but as a general rule waiting is not a state of mind or matter which causes one to grow wildly hilarious. Apart from the dullness that accompanies inaction, be the latter masterly or otherwise, unless the person, place or thing for which one waits is hedged in or bounded by a pronounced degree of suspense, there is always the suspicion that the realization will fall far short of the anticipation; yet I am happy to say that in the present instance, although we waited, and were in suspense, that for which we waited, when it was realized, was fully up to the pleasurable anticipations formed by us. To say that every railroad artery, speaking in the "through" sense, in the circulation of travel to and from Chicago, is congested just now, is to put it rather mildly. Everything seems to lead to and from the Windy City, and it is really wonderful that the trunk line carriers manage to come as close to their time schedules as they are doing. However, after many delays, No. 9 on the Pennsylvania, with its three large sections, finally brought us to the Mecca of our hopes, and our discomforts were soon forgotten in the excellent reception tendered us by the proprietors of the Grand Pacific, to whom we had entrusted ourselves "well in advance." Tuesday afternoon and evening, the headquarters at the Hotel Victoria were plentifully profuse in gas men, and when the Council met in session it looked a bit as if the attendance record of the Association was about to be made on the occasion of its coming of-age convention. East and West, North and South sent their representatives, and from the hit-and-miss chat of the bubbling conversation that went on, so far as the same concerned the "state of trade" and the immediate prospects thereof, one could not fail of being convinced that gas was still the light of the present. When the hours were into the wee and small, good night was said, and then for the morrow.

Bright and early on Wednesday, with commendable promptitude, the spry man from Macon called the assemblage to order, and from the business-like way with which the proceedings commenced even the dullest (supposing it possible that a gas man can ever be dull) could determine that no time was to be wasted in finishing the matters in hand. The attendance was good, and the weather conditions, which were simply perfect, added to the completeness of the meeting hall and the preliminary preparations for the meeting, put everybody in good humor and kept them so. The attendance was not only large but thoroughly representative. In the crowd easily distinguishable were Col. Croul, of Detroit, as much at his ease as if such a person as Mayor Pingree, of Detroit, never existed; Mr. Greenough, of Cleveland, smiling and contented, giving no evidence that he unduly felt the burden laid upon him of selling gas at the lowest figure in the country without letting his shareholders fall into financial oblivion; Mr. Vanderpool, sedate and distinguished, evidently contemplating the near approach of the time when the growth of Newark would oblige him to erect another huge addition to the plant which has been so productive under his administration of its fortunes; Commissioner Barker, with unruffled brow, never from his demeanor giving an inkling of the stormy times that beset him and his colleagues last term of the Massachusetts Legislature, when the members thereof seemed bent on wrecking the Gas Commission and the gas companies of the State. Then, too, were the Gardners, father and son; Mr. Jas. R. Floyd; the Ramsdell-McDonald combination; Mr. Hallett, possibly ruminating on the necessity that would soon carry him back to the "dripping season" of his new field in Oregon; Mr. W. W. Goodwin, whose reappearance among the boys was the signal for a rousing cheer—but I might as well stop this recounting just here, else I will have space for naught else.

President Boardman read a most entertaining and instructive address, about which, no doubt, the JOURNAL will have something to say at another time. It was logical and positive and thoroughly reasonable. The papers, with the exception of that presented by Mr. Shelton, were not

lengthy, but they were all interesting and well received. A fifth number, entitled "Mathematical Analysis Applied to Photometrical Observations in Legal Cases," was presented by Mr. Fred. B. Wheeler, of the East Chester Gas Light Company, of Mount Vernon, N. Y. Mr. Shelton's paper on "Gas Engines in the United States," was quite in that gentleman's best style. The paper proper is an excellent presentation of a problem the importance of which to our gas companies cannot be overestimated, and the appendix is a mine of carefully compiled information respecting gas engines on the American market which will often be referred to. Both paper and appendix show that a vast amount of labor and research was expended in their compilation. The papers by Messrs. Somerville, Crisfield and Thompson, which really had much in common, in that they treated on the different phases of the subject of purification, were good models of style and thought, and gave rise to a lively discussion. The Question Box was a fruitful producer of matters of interest, and, taken as a whole, the technical side of the convention was fully up to the requirements of an engineering body which had survived 21 years of a gradually progressive existence.

The increase of the membership was perhaps not as pronounced as that reported in recent years, still not much complaint is to be uttered even on that score, since 17 new names were added to the rolls, of whom 11 appear in the active class, the associate division, of course, claiming the remainder. The officers chosen by the Association for the ensuing year are:

President—W. H. Pearson, Toronto.
First Vice President—Walton Clark, Philadelphia.
Second Vice-President—A. W. Littleton, Quincy, Ills.
Third Vice President—C. J. R. Humphreys, Lawrence, Mass.
Secretary and Treasurer—A. B. Slater, Jr., Providence, R. I.
New Members of Council—W. R. Addicks, Charles R. Faben, Jr., K. M. Mitchell, C. H. Nettleton.

From this it will be seen that the gentleman placed in line of succession to the presidency is Mr. C. J. R. Humphreys, whose yoeman service to the Association during his occupancy of the Secretary's position must still be fresh in the mind of the membership. The selection is a most excellent and representative one. The Association selected Washington, D. C., as the next place for meeting, a choice that seems to meet with decided approval.

I have thus given you in brief outline what was accomplished at the technical and business sessions of the convention, and to the foregoing I may add that President Boardman and Secretary Slater were admirably aided in their well-directed efforts to expedite business by the members, who appreciated the situation at its direct value—business first and then the Fair. The local Committee of Arrangements have had their time pretty well taken up in attending to the vistors, and while it may not be necessary to so state, it is nevertheless true that that time and attention have not been grudgingly given.—***

CHICAGO, October 19th, 1893.

Dear JOURNAL: Conformably to the course marked out by the Committee of Arrangements, who this year decided to adhere to the letter of the resolution deciding not to accept any hospitality at the hands of the city visited, in the shape of a banquet, the feast of reason and flow of soul was a subscription affair, and it was enjoyed last evening by about six score of gas men. You may rest assured that a thoroughly fraternal gathering participated in a delightful reunion within caterer Kinsley's walls. The indomitable and inimitable Captain directed the proceedings with his usual spirit and go, and the evening's entertainment lacked not a bit of zest. To-day at noon the members and guests will put themselves in the hands of the Committee of Arrangements, who have chartered the steamship Arthur Orr for the purpose of conveying the party to the Fair by way of the lake. It is rather sad to reflect that we will not discover anything in the way of separate representation of the gas industry at the Exhibition, but the satisfaction of knowing that millions of cubic feet of gas are being consumed daily in this great city remains. The crowded condition of Chicago at present is simply beyond imagining—one must be on the ground to appreciate it. And the cry is still they come, for the week is to wind up with a formal celebration of Manhattan Day. In fact, there is no mistaking it that many of the Tammanial Tigers are now on the ground, a circumstance that does not in the least seem to discompose our genial toastmaster of last night, who, in his capacity as Senior Captain of the Old Guard, will aid Major Sloane and his comrades in giving to Mayor Gilroy and his associates ample protection—always providing that the Mayor and his associates are likely to need protection! To sum it all up, the Chicago meeting must be written a success, through whatever light the observer may see fit to look upon it.—***

[A Paper read before the Society of Gas Lighting.]

The Hazelton or "Porcupine" Boiler.

By DR. A. W. WILKINSON.

"There is nothing new under the sun." So said Solomon, the wisest man that ever lived. He had diamonds and jewels, gold and silver; he built the most magnificent temple that man ever looked upon; he had 40 wives and 70 concubines, and if there were steam boilers in that day, he must have known all about them. But ancient history fails to give us any account of anything that could be called a steam boiler. They had in some of their temples vessels arranged so as to generate steam, which would enable the priests to delude and play upon the credulity of the ignorant and superstitious, enabling the priests to go heavenward in a cloud. Often the show was added to by the aid of lights through red glass, which had the appearance of tongues of flame—*a la* Black Crook. Without valves or pressure gauge these vessels must frequently have sent the operator to heaven without the aid of wire rope.

For real practical use, we date the discovery of the steam boiler from the latter part of the eighteenth century. At first it was an iron cylinder partly filled with water, so arranged that a fire could be built under one end, and the heat passed under and out at the opposite end—the cylinder boiler. This was improved upon by making the products of combustion return through the boiler—the return flue boiler. Soon we have the boiler arranged for placing the fire in one end or fire box, the products of combustion going through a number of small tubes, surrounded by water, enclosed in the outer shell—the tubular boiler.

Not being satisfied with this, engineers saw the advantage of having water in the tubes and fire outside—the water tube boiler. It was soon found that the ends of the tubes which were expanded into a box at either end often leaked. This was owing to the unequal expansion of the tubes, for it was impossible to heat the tubes to the same degree all over; some of the tubes would have the water driven completely out, and, there being only steam in the tube, it soon became red hot, causing expansion, and, as a consequence, loosening the expanded joint. To overcome this difficulty return bends were used, which in part prevented the trouble, but added another; that is, the bends were often broken. Again, the water and steam never would decide which should be on top, so that an engineer was never quite sure which he was going to feed his engine with—it might be steam or it might be water. To do away with this difficulty a large iron cylinder was placed on top of the boiler, large enough to hold all the water and a little more, so that if the heat were such as to relieve the tubes of all the water, there was a place for it to go; at the same time, the cylinder would act as a steam drum. A little use of such a boiler demonstrated the value of water tubes; they would generate steam quickly; they were economical in fuel, the poorer or waste coal giving almost as good results as the best; the grate surface was large, hence a thin fire could be carried and the coal could be burned to the best advantage. But the difficulty of leaky joints and priming still remained.

To overcome these defects, a man by the name of Hazelton presented to the late Mr. J. P. Kennedy a form of boiler (which now has his name), composed of a large center tube several feet in length, depending upon the size of the boiler, standing on end, from which smaller tubes radiate from all sides; these tubes are expanded into the center tube, starting a few feet from the bottom. The center tube is closed top and bottom with the usual boiler heads and the smaller tubes are closed at outer ends. The whole is placed in a brick stack, and the grate surrounding the center tube below the smaller tubes forms the place for firing; the whole seemed so new and feasible that patents were prepared and applied for. Return mail brought from the Patent Office several references, showing boilers of similar construction, and the words of Solomon, that "There is nothing new under the sun," came forcibly to mind.

Upon examination of these references, Mr. Kennedy was not long in detecting the shortcomings of their constructions and the reasons why they had been failures, if, in fact, they had ever been constructed.

In the year 1879, when the New York Mutual Gas Light Company was making coal and wood gas enriched with naphtha, its President and Engineer, the late Mr. John P. Kennedy, sought the best means to utilize as fuel the large quantities of coke breeze and wood charcoal then produced, and which had no commercial value and involved considerable expense in removal from the works. As we all know, Mr. Kennedy was a very practical man, a thorough mechanic and an excellent manager of business affairs. His lengthy and varied experience in the gas industry, dating back to its earliest days in this country, well fitted him to discover and apply improvements and institute economies, which in the end resulted successfully; for, if one thing did not reach the desired result, he continued experimenting with others until successful.

When he determined to utilize the waste combustible materials above referred to, a series of experiments was instituted. First, trying to consume this waste fuel in the best forms of fire tube boilers, under natural draft, with slow combustion ; afterwards, applying several mechanical fuel saving devices to said boilers, but the results were not satisfactory. He then sought the market to determine if there was not some boiler which would successfully handle this fuel, but investigation convinced him that such was not the case.

About this time, Hazelton called upon him and presented a fuel-saving device, but Mr. Kennedy had already tried it, and Hazelton was convinced of the fact, after he accompanied Mr. Kennedy to the works, and was also satisfied that something beyond this was required. It was then that Hazelton presented his ideas of a boiler which he thought would be particularly well adapted to the requirements, and which, with the many improvements since made upon it by its manufacturers, has become the justly celebrated boiler of that name. After several conferences with Hazelton, Mr. Kennedy concluded to build a boiler of the kind suggested, and decided upon having liberal capacity, in accordance with his usual custom in matters of this kind. Mr. Henry F. Allen, the present Superintendent of the Mutual Gas Light Company, made all the necessary calculations and prepared the drawings for the first boiler, to be of 275 horse power. It was completed and started on August 8th, 1880, and fully solved the problem, for it consumed the fuel referred to in the most perfect manner.

The boiler has been in active service ever since that time, and bids fair to perform its duty for many years to come. This boiler made all the steam required in the works during the spring, summer and autumn, using no other fuel than that before referred to ; later, as the business of the Company increased, and owing to the fact that water gas had a growing popularity and had become less expensive to produce than coal and wood gas, Mr. Kennedy then concluded to make water gas exclusively, which required more boiler capacity, and consequently, with the installation of the water gas making apparatus, three additional boilers of the same capacity were added to the plant, making a battery of 1,100-horse power. When the residue of coke breeze and wood charcoal had been consumed, these boilers were fired with the screenings from the anthracite coal used in water gas making, with equally good results. It made no difference what kind of combustible material was employed, they consumed it perfectly. The first boiler had been in operation for four years, and in the meantime patents had been taken out for improvements.

After a four years' trial, Mr. Kennedy concluded that it would be well to introduce the boiler to the public notice, and give steam users the benefit of this very remarkable steam generator. It was early in 1884, when his two sons, Edward S. T. Kennedy and William T. Kennedy, became interested with their father and Hazelton, and a suitable manufacturing plant was installed in buildings adjoining the gas works; literature was issued, and the business was commenced in earnest.

Mr. Kennedy's knowledge and skill as a mechanic, as well as a business man, again proved of value at this time in establishing the plant and shaping the policy of the concern. It was determined to test the commercial value of the boiler by building and placing 100 of them of various sizes among the steam-using public, and thus securing the opinions of intelligent steam users respecting this boiler. Long before this number had been sold, the great value of the boiler had become a settled fact, but difficulties presented themselves which would naturally follow from placing boilers in various localities, under varying conditions, and not always handled by skillful men. It was found that certain changes in proportions and in construction would have to be made, and improvements were instituted to insure the permanent success of the boiler. One of the prolific causes of trouble was the failure of the radial tubes, which were then closed by welding a disc in the outer end of each tube. This trouble was partly due to the fact that the majority of steam users are prone to buy too small capacity, and in overworking the boilers to get the steam required the intense heat generated would either rupture the tubes, produce leakage, or some of the discs would become loosened and leave the tubes. Various methods of placing these discs in the tubes were tried, and the tubes placed in working boilers. In some instances they proved successful, while in others they did not. In the effort to overcome these difficulties, there followed a long series of experiments occupying many months of anxiety and hard work, and involving large expense, but resulting in a most satisfactory solution of the difficult problem, as will be seen.

Another cause of the failure of tubes at this time was due to the draft space between the tubes at their outer ends being so greatly in excess of the space presented between the tubes at the standpipe, that the currents of heated gases, instead of passing up, as they should, alongside the standpipe and in contact with the tubes at end toward the standpipe, would pass up in the free draft spaces at the outer ends of the tubes, and ultimately destroy many of them.

After trying various plans to divert these heat currents to their proper channels, such as placing deflecting tiles and deflecting plates of wrought and cast iron below and above the bottom row of tubes, and at other points above, placing covering tubes over the outer ends of the tubes, building firebrick and tiles into the enclosing walls of the boiler and allowing them to project inward under the tubes, etc., etc., all of which proved more or less efficient for a brief time, Messrs. Kennedy determined that something more permanent was required, and it resulted in the discovery, invention and application, by Mr. E. S. T. Kennedy, of the present deflecting furnace and deflecting plates, which are illustrated and described in the literature of the Hazelton Boiler Company, of this city. The discovery and ultimate perfection of this deflecting furnace and the deflecting plates represented a vast amount of thought, labor and expense, not only in reaching the proper construction, but in determining the proper proportions.

Those who are familiar with gas making and its kindred industries will appreciate the value of this deflecting furnace, which acts as a retort, in that it absorbs and holds heat, and its heating surfaces being so large, that the lighter combustible gases, which might otherwise go to waste up the stack, coming in contact with it are intercepted, ignited and consumed. When this boiler is properly fired, and all other necessary conditions observed, the percentage of escaping combustible gases is reduced to the minimum. The proper way to fire the boiler is to maintain a clean, thin fire in a state of incandescence at all times, which is secured by frequent firing of small quantities of fuel evenly spread over the grates. If bituminous coal is used, provision is made for the introduction of heated currents of air, which enter the furnace just above the level of the fire, which, in conjunction with the deflecting furnace, largely facilitate and perfect the combustion and insure the consumption of the gaseous products of the fuel. With anthracite coal, these heated air currents are not required, and the damper in the outer end of each air pipe should be closed.

When properly handled and fired, this boiler will consume any refuse combustible material with results not heretofore realized in steam practice. It is a boiler that can be easily handled and kept clean. It is the only boiler in the market that is accessible for complete internal and external examination and cleaning. A manhole is provided in lower end of standpipe below grate bars, through which the standpipe can be entered, examined and cleaned from top to bottom. The small iron doors placed in the brickwork setting permit the introduction of a steam or air-jet, for the removal of the dust from the exterior of the tube, which operation can be performed while the boiler is at work ; therefore it can be readily seen that it can be easily and perfectly kept clean at all times. It is customary to let the boiler down every four to six weeks, depending upon the purity of the water used, for internal examination and cleaning, at which times thorough external cleaning can be effected. It is a good plan to remove the dust deposits from the exterior of the tubes at frequent intervals, depending upon the nature of the fuel used and the amount of dust deposit.

This boiler does not need the lofty brick chimney or stack required by ordinary boilers, as the brickwork enclosure, from the level of the grates upward, forms the largest portion of required stack, and it is necessary only to add sufficient iron stack to clear the roof of the boiler building, or any adjoining loftier building, from 5 to 10 feet. The draft currents from the fire naturally take an upward course, and the area of the chimney described by the brickwork enclosure of the boiler is so largely in excess of the draft requirements that when the damper in the smokestack is almost closed and only one of the ashpit doors partially open, sufficient draft will be produced to realize the full rated capacity of the boiler, and at the same time maintain an incandescent fire on the grates. If water be kept in the ashpit of this boiler, as it is in other boilers, it will be found advantageous; it keeps the grates partially cooled, and prevents the clinker from adhering to them ; the vapor of water passing through the strata of incandescent fuel will become partially decomposed gas as formed and ignited. The value of these added heat units is fully utilized.

When it becomes necessary to clean fires, only one furnace door should be opened at a time, and that portion of the fire thus reached be cleaned first and fresh fuel put on ; then the next section cleaned, and so on, until the third is in proper condition, which prevents the undesirable introduction of cooler air currents from without, lowering the temperature of the heated gases in the furnace and thus preventing combustion. If the fire is cleaned in halves or thirds, depending upon the number of furnace doors, considerable economy will be effected. Numer-

ous economy tests of this boiler have been made, and the results derived have never been surpassed, if ever equalled by any other boiler.

The boiler is constructed with due regard to every requirement of safety, durability and economy, and, in perfecting salient features, due attention has been given to every minor detail as well. The construction of the steam take-off in the top of the standpipe is such that the steam is considerably superheated, which renders it particularly valuable in the production of water gas, as you will fully understand and appreciate; and this feature, coupled with the fact that the boiler can be operated with cheap refuse combustible material, will at once commend it to all who desire to acquire the best boiler, whether it be placed in use for gas making or in any other industry. Subsequent to the discovery and perfection of the deflecting furnace and plates, Mr. W. T. Kennedy invented the round-end, homogeneous tube, now used exclusively in this boiler, and which has contributed largely to its success, and a few months later, Mr. Kennedy invented and has constructed special power tools to supplant the hand tools formerly used in this tube closing process. The power tools not only largely increased the production, but did the work more uniformly and were in every way a success, and are an important feature in the very complete manufacturing plant in which these boilers are made.

The Hazelton Boiler Company has possessed great advantage in having gentlemen of superior mechanical skill connected with it, who have improved the boiler from time to time as requirements demanded, until now they have brought their boiler to the highest perfection. This concern builds each boiler of liberal capacity, uses the best materials, applies the best workmanship, and each and every boiler it turns out is constructed under the personal supervision of its officers, who take such pride in their boiler and in producing good work that they have been rewarded by seeing it appreciated by some of the most intelligent and progressive steam users in this country. Some of these boilers have been shipped abroad where they have been equally successful, and at the present time there are about 800 boilers in successful operation in almost every industry, and representing about 100,000 horse power. Quite a number of them have been placed in gas works throughout the United States, and I am pleased to testify that they have played no small part in the success of water gas making.

This boiler is built to-day under patents taken out by Mr. Kennedy and his son, covering all these improvements upon the original boiler as presented by Hazelton, which have insured its success. I believe it is to be the coming boiler of the age; that it will be more and more appreciated as time rolls on. Its absolute safety under very high pressure, the full and complete provision against leakage due to unequal expansion and contraction, its accessibility for complete internal examination and cleaning, its great economy of fuel as well as floor space, its freedom from scaling, the infrequency of repairs, which are easily made when necessary, and last but not least, the protection against atmospheric cooling afforded by the brickwork setting, comprise a series of indisputable arguments in behalf of this boiler.

In different parts of this country, where fuel is expensive and economy a necessity, many of these boilers have been in operation sufficiently long to fully prove their value, and the results have been entirely satisfactory to both the manufacturer of the boiler and those using it. I will now proceed to give you the results of a number of tests made for evaporative capacity during the regular runs of the plants by mechanical engineers of the highest intelligence in steam matters. These tests were made to ascertain the quantity of water evaporated, from and at 212° F., per pound of combustible, thus showing the value of the boiler.

The United Electric Light Company, Springfield, Mass., 200-horse power	11.30 lbs.
The Auburn Electric Light Company, Auburn, N. Y., 150-horse power	10.53 "
A. Pardee & Co., Hazleton, Pa., 200-horse power	12.40 "
The Thomson-Houston Electric Company, Minneapolis, Minn., 250-horse power	11.78 "
The New York Mutual Gas Light Company, New York City, 275-horse power	10.75 "
The Plymouth Coal Company, Wilkes-Barre, Pa., 250-horse power	10.96 "
The Memphis Light and Power Company, Memphis, Tenn., 200 horse power	11.41 "
Interstate Grain Company, Minneapolis, Minn., 125 horse power	10.94 "
The Consolidated Gas and Electric Company, Port Chester, N. Y., 125-horse power	10.43 "
The Syracuse Heat and Power Company, Syracuse, N. Y., 500-horse power	11.58 "
Royal Egg Macaroni Company, Minneapolis, Minn., 75 horse power	11.56 lbs.
Possible	15.00 "

In the American Gas Light Journal, of February 29th, 1892, will be found a copy of a paper read by Frank S. Richardson, Esq., Treasurer North Adams Gas Light Company, North Adams, Mass., before the meeting of the New England Association of Gas Engineers, from which I quote as follows: "The first feature of which special mention is made is the Hazelton boiler, and, although granting that our experience is small, yet results from such a steam plant must stamp it as the very best, in every respect, that is to-day offered to any one desiring steam power, and especially to gas companies furnishing electricity. With the feed water at about 112°, which is without use of a heater, we evaporate over 7 pounds of water per pound of coke, and almost 10 pounds with soft coal. This is an average of over 20 pounds of water evaporated per indicated horse power per hour, upon an average of 1.9 pounds of coal per horse power per hour, and 2.2 pounds of coke per horse power per hour."

In above tests various kinds of fuel were used, such as pea and buckwheat coal, bituminous slack, etc., in fact, the cheaper grades of fuel. This boiler has such liberal heating surface that it will practically develop its full rated capacity with almost any known refuse combustible material of the coal series, and make an excellent showing with sawdust, shavings, chips, tanbark, manure, etc.

Gas Supply in the Far East.

[Communicated by Mr. F. G. Cockey to the London *Journal*.]

Different as are the conditions under which gas manufacture is carried on in a Chinese port from those which exist in an English town, it may be interesting to some of the readers of the *Journal* to have a short description of the works of the Shanghai Gas Company.

The Company, which is entirely a local one, having no agent or offices in England, was formed in 1864 with a capital of 150,000 taels, in 1,500 shares of 100 taels each. The Shanghai tael is not a coin, but a certain weight of silver; and at the time the writer first went out, in 1887, it was worth $1.09. Since then it has been up to $1.25, and it is now about 87½ cents. Owing to the fact of the capital being in silver, and dividends, as well as all working charges and salaries, being paid in the same currency, the Company has suffered less from the depreciation of silver in relation to gold than those companies which, working in silver-using countries, have their capital in sterling. In the year 1886, the profits had so increased that the capital was "watered" by the distribution of 500 more shares.

To understand the development of the undertaking, it must be explained that the district supplied consists of a strip of land about a mile wide, on the left bank of the Whangpoo river, along which it stretches for about 4 miles. This was granted, under the treaty of Nanking, subject to certain regulations for the residence of foreigners. In addition to this, there is the French concession, which is a plot roughly a mile square, situated at the south end of the foreign settlement, and extending from it to the walls of the native city. At the time the Shanghai gas works were first started only a small portion of the settlement was built upon, and the only gas consumers were the Club and the large European "hongs," or mercantile houses, which were clustered together in in the southeast corner on the river front—the French town having its own separate gas company and works. Since that time there has been a great increase in both the native and foreign population; and the former, whose only illuminant was cotton seed oil, have come to recognize the advantages of the "foreign devil's" new light. Nearly the whole of the settlement is now laid out in building plots, with well made roads; and it is being rapidly covered with houses of all classes, from the handsome villas and business houses of the foreign merchants to the open fronted, pole framed huts which serve as shops and dwellings for the poorer class of Chinese. The settlement is governed by a Municipal Council elected by the ratepayers, which has the control of roads, drainage, police, lighting and sanitary matters; and few English towns of the same size are as well served in these departments. About 10 years ago a company was formed for the supply of electric light; and the Municipal Council decided to illuminate the main streets of the settlement with arc lamps. Owing to the exaggerated value it was then usual to assign to these lamps, they were at first placed too far apart and too high, making the distribution of light very patchy and irregular. Recently, however, the number of lights has been increased, and where the roads are broad and straight, and without trees, the result is fairly satisfactory. A few years later an incandescent light plant was put

down by the same company, and the Shanghai Club and one or two of the large "hongs" were fitted up with the light.

The loss of these consumers, of course, caused a temporary falling off in the Gas Company's business; but only for a very short time, as the rapid increase in the number of natives who burnt gas more than compensated for the few large houses which no longer required it. This increase was largely due to a system of supplying native houses with pipes on loan, and fitting them free of cost, which was adopted in Shanghai (on the advice of the Company's Chief Engineer, Mr. H. Edwards) in 1888, or about the same time that a somewhat similar scheme was being tried by Mr. Valon at Ramsgate. As in the native houses the pipes can be run outside the woodwork of the walls and ceilings, the cost is very small; and it was found that the increased consumption of gas very soon repaid the outlay on the pipes, etc. Brackets, pendants and globes are charged for, but all the permanent fittings are supplied gratis. A very liberal policy is adopted towards all classes of consumers. Meters and services are fixed by the Company free of cost, and no meter rents are charged, though a deposit is occasionally required. All leaks, unless caused by actual damage to the fittings, are repaired, and pipes and services are cleaned, when necessary, without charge; and a large stock of modern fittings, burners, globes, etc., is kept at the works and sold at prices that little more than cover cost. Meters are inspected and accounts collected monthly. This necessitates a rather larger staff than would otherwise be needed; but it is found to work well, as the number of bad debts is very small indeed, and the regular attention to the meters, which are all wet, goes far to reduce the number of complaints, and does away with the principal drawback to meters of that class. It has been found that dry meters do not last long and are unreliable in the Shanghai climate, the skins soon getting hard and dry.

As all the fitting thoughout the settlement is done by the Company, a large staff of native fitters has to be maintained. These men have been trained in the Company's service under their foreman (Mr. Goodfellow), who, in addition to superintending the outside fitting and repairing work, tests and repairs all the meters. The wages of native fitters run from $3 to $8 per week. The best of them are fairly good, careful workmen, though very slow, and requiring a good deal of supervision. On the whole, skilled labor in China is little, if any, cheaper than in England: for, although wages are lower, owing to the ridiculously small cost of living for a native, it takes at least two Chinamen to do the work of one Englishman. They are, however, docile and sober; and this goes far to make up for their shortcomings. Unskilled or coolie labor is cheap and abundant; and as a coolie only gets about 75 cents or 87½ per week, there is a large margin between his wages and those of the British laborer. It would therefore hardly pay, under these conditions, to adopt costly machinery for stoking and handling coal.

The Company's works stand on an oblong plot of land just outside the limits of the settlement, at the junction of the Defence Creek (its western boundary) with the Soochow Creek, which is a large tidal waterway forming the principal high road to the interior of the country. The plant, which was not originally laid out with a view to such a growth as has taken place, is now awkwardly crowded; and much of it is of a somewhat obsolete type. The retort house contains 7 beds of 5 through retorts, and is flanked on either side by a large coal store, into which the coal is carried (in baskets, by coolies) from the cargo boats alongside the wharf. Retorts, firebrick and fireclay, as well as all ironwork, have to be imported from England; and the freight and loss by breakage, together with the exchange, bring up the cost of a bench of retorts to nearly double that of a similar bench in England. In adding to the carbonizing plant, it has been decided to put in a modified form of regenerative setting. The chief difficulty is the fact that the floor of the retort house is only a few feet above high water level; and, in digging, water is found 2 or 3 feet below the surface.

The condenser is of the vertical annular type; the scrubber, a square tower filled with coke and bamboo strips, and wetted with liquor from the "Standard" washer which follows it. The whole of this plant is to be duplicated to accommodate the rapidly increasing make. In a climate where the shade temperature ranges from 15° to 105° F., it is necessary to protect the apparatus from the weather; and not only are the condenser, scrubber and washer in a shed, but during the severe winters the pipes have to be covered with hay-band and sacking to protect them from the cutting northwest wind, which finds its way in through every opening. It is also found necessary to carefully board up every aperture on the north side of the retort house during the cold weather, as the sudden chilling of the "saddles" and the hydraulic main used to cause the most obstinate stoppages; and the writer has been up night and day, with a gang of men, removing solid pitch from the foul main, which on one occasion was so full that it was found quicker to cut out a length of pipe and put in a new one than to remove the obstruction in any other way. A pair of Gwynne & Beale's exhausters pump the gas from the washer into a set of 6 purifiers, 3 filled with oxide followed by 1 lime box. As there are no sulphur clauses to worry the gas manager, this method answers well enough, especially as lime is costly, and has to be brought from some 60 miles up country; and the native merchants always manage to find out when the stock at the works is low, and combine to raise the price. A Hislop's lime revivifying kiln has been fixed, to render the works a little more independent of the wily native. Oxide was formerly imported from England, and was an expensive item; but that which is now used is prepared on the works from old iron borings, purchased at a very low rate from the machine shops at the docks. The borings are spread on a floor, and well pounded and watered; and after a week or so they are mixed with sawdust, and are then ready for use.

The storage plant consists of 4 holders of various sizes; the total capacity being 319,000 cubic feet. The last new holder, erected in 1891, will contain 119,000 cubic feet of gas. As the maximum consumption is only about 250,000 cubic feet in 24 hours, the Company are fairly well off for storage. The holders are all single lifts. The tanks are of wrought iron, with cast iron bottoms; and the guide framing is composed of cast iron columns on wrought iron lattice piers, bolted to the tanks, and resting on brick foundations—the top ends of the columns being connected by light lattice girders. Wrought iron has been adopted for the tanks partly because of the saving of freight, and partly on account of the rotten and waterlogged state of the soil. The tanks are only sunk into the ground for about half their depth, as it is difficult to excavate without disturbing the surrounding structures. It has not been considered safe to adopt telescopic holders, owing to the violent typhoons to which they are sometimes exposed. In constructing the new holder, the old type has been adhered to, presumably for the sake of uniformity, as there is little doubt that one might have been designed with a wrought iron or steel framing, properly connected to the tank, that would have cost less, and might safely have had a second lift added when a further increase of storage was required.

The governor house is conveniently arranged with the inlet and outlet valves for the holders; and all the connections are easily accessible in the basement. A testing and photometer room, an experimental plant and a block of buildings containing offices, stores and dwelling houses complete the works.

Gas coals of very fair quality are obtainable from the Miikie mines in Japan, and from Keelung in Formosa. A mixture of these two, with a very small proportion of Australian boghead or shale, is found to work very well, yielding about 10,000 cubic feet of 19 or 20 candle gas per ton, and a coke which, though rather soft, is readily marketable. The average cost of coal, including shale, is a trifle less than 5 taels, or about $4.50 per ton. The gas produced from these coals is rather high in sulphur, but so low in ammonia that it would be difficult to get the scrubber liquor up to a marketable state, even if there were any sale for it. Tar and coke are readily salable; and the whole make of both, together with the ashes, is sold by yearly contract at very fair prices.

There are about 20 gas engines in use in Shanghai, from 5 man to 20 nominal horse power, nearly all of Messrs. Crossley's make. The Company supply these "Otto" engines at practically cost price, and keep them in order free of charge. Cooking by gas has not taken any hold in Shanghai, as the cost of gas does not leave much margin of saving against the cost of coal, and it is impossible to get the native servants to use it economically.

The price of gas for lighting purposes is $2 per 1,000 feet, and for gas engines and cooking stoves, $1.75. This price is, I believe, lower than in any oth r port in the East, and it will probably be still further reduced as the consumption grows. The effect of each reduction in price hitherto has been to cause a very marked increase in the next year's make. The shareholders have also benefited by the liberal policy adopted, as a dividend of 12 per cent. per annum has been paid for many years, and a reserve fund has been formed out of revenue which has now reached the limit of 100,000 taels, and the interest on this sum is now divided amongst the shareholders. In 1891, the Shanghai Gas Company obtained the contract for the public lighting of the French concession, and bought out the French Gas Company. The old works were pulled down and a connecting main laid from the English works to the new district. As the price of gas in the French town was thus reduced by about 50 per cent., the number of consumers increased so rapidly as to tax severely the resources of the fitting department, and in the winter of 1891 2 it was all the works could do to keep up the supply.

During the writer's five years' residence in Shanghai, the popularity of gas has been steadily advancing, and the introduction of elec-

tric lighting seems to have stimulated it rather than otherwise—possibly by encouraging a desire for more brilliant illumination, possibly by causing increased efforts on the part of those in control of the gas supply, or from both causes combined. By far the most dangerous competitor of gas is the excellent kerosene oil imported in such large quantities from America, and the improved lamps in which it is burned. These have taken a great hold among the natives, and, considering the inflammable nature of their houses, it is wonderful how rarely a fire can be traced to the explosion or overturning of an oil lamp.

Since the foregoing notes were written, the Municipal Council of Shanghai have been considering the advisability of purchasing the Electric Light Company's plant and undertaking the supply themselves; and they eventually decided to do so. Some time ago the Directors of the Gas Company had the same question before them, and a valuation of the electric lighting plant was made. But they decided not to proceed with the matter. It will be interesting to see how municipal management will succeed in carrying on a business from which a private Company failed to make any substantial profit.

Something of Interest in Relation to the Electrolysis of Gas Pipes.

The destruction of gas and water main and service pipes by the powerful electric currents now necessarily used for moving the cars of street railways has become so serious as to engage the attention of the foremost gas and hydraulic engineers everywhere. Serious explosions have been traced to this source, and the damage done (and steadily going on) is almost beyond computation. It would therefore seem that the simple remedy proposed by Mr. Frederic Egner, of St. Louis, would receive a speedy trial, especially as some other methods, such as inclosing the pipes in wooden boxes, sewer pipe or cement, have been largely tried, and have offered only a partial relief. The inventor states facts which are well known and appeal to the commonsense of the reader. It is well known, for instance, that the earth is a large magnet, and this fact has been taken advantage of by the operators of telegraph lines, almost since the first inception of the electric telegraph. Return wires were found unnecessary, the earth being used for that purpose; but the currents employed in telegraphy were not powerful enough to damage anything. With the advent of the electric street railway, however, such immense and powerful currents were required that it was soon found these frequently caused electrolysis of the metal pipes of gas and water companies buried in the earth. This effect is mainly caused where pipes are crossed by the rails of electric railways, and, therefore, if the pipe in danger is protected at these points the trouble may be entirely avoided. If, for instance, the poles of the electric bath were to be connected by means of a wire of sufficient magnitude, the bath would become inoperative. The current used would naturally seek the easiest road, which would in that case be via the connecting wire.

It is so with the currents used by electric railways. The rails are, of course, connected, and it is supposed that thus the current is returned to the generating station; but no one acquainted with electrical science will assert that this is the case, especially in wet weather. The currents seek the earth, and if in their passage a gas or water main is encountered it suffers, as we know. If the pipes affected were *above* the rails as far as they are *below* them, they would not be touched at all, because the course of these currents is *invariably downward*, towards the center of the earth. Hence it follows that if we interpose, between the rails from which the currents escape and the pipes which are in the course of the escaping currents, a conductor of a more susceptible material than that of which the pipe to be protected is composed, we shall be able to conduct the dangerous current below the pipe, where it can no longer do any harm, or in the same way as a powerful flash of lightning is rendered harmless by a good lightning conductor.

That seems to be the object of the invention which we present to our readers for their consideration herewith. Using the language of the specification:

It has been discovered that the powerful electric currents employed to drive the dynamos of street railways have a decidedly injurious effect upon the service pipes and mains used for distributing gas and water, causing serious and often dangerous leaks; and it has been discovered that quite newly put down pipes have been thus affected, and that serious accidents have resulted therefrom. Various expensive methods have been suggested and some have been tried, to protect the pipes from the action of these currents, but the following is found to be a cheap and reliable preventative.

Reference being now made to the accompanying drawings, Figure 1 is a side elevation of main pipe, such as is ordinarily used for the distribution of gas and water; also showing the application of my invention in one form. Fig. 2 is a similar section of main pipe, showing the application of my invention in another form. Fig. 3 is an end elevation of same pipe, also showing a service pipe connected to said main and my invention.

A wire of copper is wound around the pipes to be protected in a continuous manner; and at distances of 100 feet more or less, copper plates are buried somewhat deeper than the pipe to be protected and connected

Fig. 1.

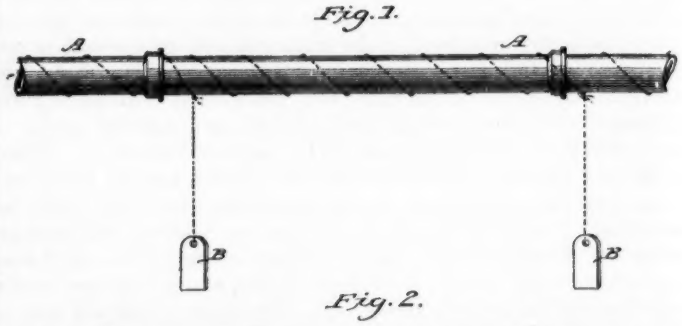


Fig. 2.

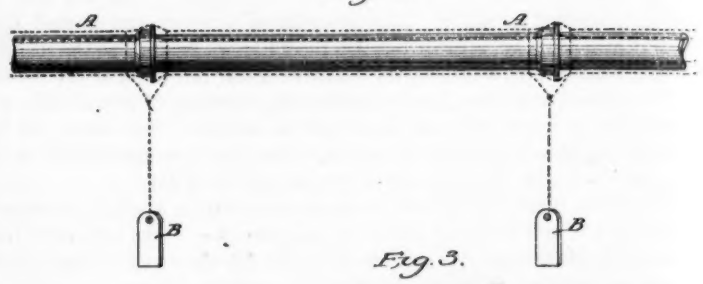
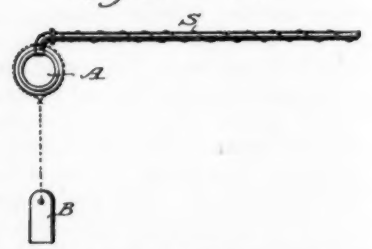


Fig. 3.



with the wire upon the pipe with wire somewhat heavier than that upon said pipe. Stray currents from electric installations or plants of electric power works, which ordinarily find and injure gas and water mains and service pipes, are thus collected and conducted away without injury to the latter.

Instead of copper wire, any other metal which is a superior conductor of electricity, than is iron or lead, from which these pipes are usually constructed, will answer.

In the drawings the wire has been indicated by dotted lines throughout, in order that same might be distinguished more easily and the method understood.

The letters of reference indicate as follows: *A*, *A*, *A*, the main pipe; *B*, *B*, *B*, *B*, *B*, the ground plates previously mentioned; *S*, a service pipe, as usually attached to the mains, and the dotted lines represent the conducting wires.

The method of application is so very simple and easily applied and effective that anyone could use it with this description of the matter.

Instead of winding the wire around the pipe, as shown in Figs. 1 and 3, the same may be laid alongside of it, though in the case of large mains more than one wire would have to be used, as shown, for instance, in Fig. 2, applied to various portions of the circumference of same; but all must be in close contact with the pipe to be protected, and all must be connected to the ground plates as before described.

Having fully described my invention, what I desire to claim and secure by Letters Patent is—

The improved system for protecting gas and water pipes, comprising the combination of wires of better conducting material than the pipes, laid around or along the same and in close contact therewith, and earth plates of conducting metal, connected therewith at intervals as described.

The Electric Search Light in Shaft Sinking.

Mr. James Baird, in the course of a paper read before the Mining Institute of Scotland, said that the electric search light has been used to great advantage in shaft sinking at the Walkinshaw colliery, near

Paisley, Scotland. The apparatus consists of an arc lamp, a lens and a mirror, the whole inclosed in a sheet iron case, 20 in. by 20 in. by 5 ft., having a sliding shutter on each side to give access to the lamp. The adjustment of the lamp is effected by a screw on the top of the case. As occasion requires it can be adjusted to diffuse light throughout the whole shaft, or be concentrated at the bottom, where the men are working. The mirror is hung on its center, and can be moved in a vertical direction, so as to deflect the rays of light to where wanted, after which it is held in position by a thumb screw. The illuminating power of this lamp is squal to between 4,000 and 5,000 candles. The dynamo is an Elwell-Parker continuous current, compound-wound machine, running at a speed of 1,340 revolutions per minute, and having an electromotive force of 65 volts, and a current of 20 amperes, which is equal to about 2 horse power.

The shaft at Walkinshaw is circular, 13 ft. in diameter, and 260 ft. deep. It is lined with brick all the way, and is free from all buntons, except those necessary for carrying down brattice boards for ventilating purposes. The shaft, therefore, was favorable for this form of light, and so bright and clear did the light illumine the shaft bottom that it had the appearance as if the sun was shining on it. In the case of an oblong shaft with, say, two midwalls, the light would not give the same satisfactory results, but this could be remedied by having two lamps; and in the event of a deeper shaft being required than the one in question, a more powerful lamp could be used, although it is believed that the one employed at Walkinshaw would answer to a depth of 1,200 feet.

From experience the following advantages were found with the electric light: 1. The light at the shaft bottom was far in excess of that got from the ordinary sinker's lamps. Consequently, more work could be performed in a given time. 2. The lamp, being stationed on the surface, could be got at easily at any time for adjustment without inconvenience to the sinkers; and in the event of the strata giving off firedamp, it would give perfect immunity from danger of explosion. 3. By the aid of the light those in charge could see from the surface what was going on below, and this is an important matter.

While the light has great advantages, it is not, however, without its drawbacks, and not the least is its inability to pierce fog and the smoke from shot firing. With good ventilation the latter can very soon be cleared off; when fogs happen, provision would have to be made to use the ordinary hand lamps.

[Continued from page 544.]

Gas Consumption.

[From "Series of Articles for Gas Students," in the London *Journal*.]

III.—*Various Types of Gas Burners.*

A careful perusal of the foregoing chapter on the principles of combustion and their application to burner construction will, it is hoped, enable the student to readily apprehend the aims of the various details and developments noted below.

Gas burners may be classified as follows:

For illuminating purposes.....	Ordinary flat flame—batswing, fishtail. Argand. Regenerative. Carbureter. Incandescent.
For heating and other purposes	Flat flame (as above.) Bunsen (atmospheric.)

The simple batswing or slit burner consists of a cylindrical metallic case, suitably screwed at the bottom for its insertion in the gasalier, etc., and surmounted by a tip of steatite or other non conducting material, in which is cut an even slit through which the gas issues. The burner is named after the shape of the flame which it gives. The best results are attained with a gas pressure of from 3-10ths to 4-10ths of an inch. The thickness of the slit will depend upon the illuminating power of the gas—the lower the latter the thicker the slit, and vice versa. This principle also applies partially to the orifices of the fishtail burner. The large batswing burners employed in high-class street lighting are provided with wings or lugs which, protecting the edge of the flame from the rapid upward currents of air, tend to maintain the flame steady and of uniform shape. Batswing burners are employed for testing cannel gas of over 20 candle power. The following are the dimensions of the special burner manufactured by Messrs. Sugg & Co. for the purpose:

External diameter of top of stem.....	0.31 inch.
Internal diameter of stem.....	0.17 "
Width of slit	0.02 "
Depth of slit.....	0.15 "

All improved forms of batswing burners—such as Bronner's, Bray's Sugg's, etc.—have the tip hollow and domed. The dome is equal in thickness throughout. Hence the slit is of equal depth throughout its length, and the gas issues with equal force from every point in the slit. Sugg's "table top" burners are provided with a projecting rim below the tip, to protect the flame from the upward rush of air.

The fishtail burner—also cylindrical in shape—has its tip drilled with two holes, which converge upwardly toward each other at an angle varying from 90° to 120°. The two jets of gas meeting each other are pressed out, and, in combustion, form one sheet of flame—the plane of which, by the way, is at right angles to an imaginary plane crossing the centers of the two holes. These burners give their best results when the gas is burnt at a pressure of about 5-10ths of an inch.

Flat flame burners should be so fixed that the surface of the flame should face, not cross, the direction in which the light is chiefly required. The cheaper forms are provided with cotton wool or other material, designed to check the flow of gas and reduce the pressure at the tip; but these, giving only fair results at first, are soon useless. Bray's "Special" burners (batswing and fishtail) however—deservedly popular and very cheap—are constructed on scientific principles. As in Bronner's burners, the gas flow is checked at the bottom of the burner case, by a plug of enamel pierced with a small hole or gas orifice, much less in area than those at the tip. The body of the burner, being of much greater sectional area than the inlet orifice, constitutes a compensating or expansion chamber, in which the gas steadies itself, as it were; and the flow is thoroughly equalized before reaching the tip. Moreover, the top of the burner is so arranged as to secure as perfect a delivery of the gas as possible. Above the inlet orifice, and near to the bottom of the burner case, is a diaphragm of muslin, which subdues the "swirl" caused by the passage of the gas through the minute orifice. The size of the latter depends upon the amount of gas to be admitted to the burner.

The argand burner consists primarily of an annular steatite ring or gas chamber, pierced with holes around its upper surface, and suitably mounted in a brass case. The latter comprises a gallery to carry a glass chimney and a deflecting cone, and also three supply tubes, which, rising from the inlet socket, constitute the support for the burner and gallery. The inlet socket is suitably screwed for fixing the burner on the gas pendant or standard, as the case may be. The combined sectional area of the three rising tubes is less than the aggregate area of the burner orifices above; hence the gas is delivered from the latter at a considerably less pressure than that at which it enters the burner by the inlet socket. Between the chimney and the burner orifices is a small metallic cone, which so directs the air supply upon the surface of the flame as to assist in perfect and intense combustion. The best results are given by this burner with a pressure of from 5 10ths to 6 10ths. Most of Mr. Sugg's argand burners are supplied with a simple arrangement in the inlet socket by which the pressure may readily, if necessary, be automatically reduced.

The dimensions of "Sugg's London Argand No. 1," specified by the Ges Referees as the standard burner for photometric purposes, are as follows:

Diameter of supply pipes (three in number)....	0.08 inch.
External diameter of annular steatite chamber..	0.84 "
Internal " " " " ..	0.48 "
Diameter of each hole (24 in number).....	0.045 "
Internal diameter of cone, at the bottom.....	1.50 "
" " " at the top.....	1.08 "
Height of upper surface of cone and of steatite chamber above floor of gallery.....	0.75 "
Height of glass chimney.....	6.00 "
Internal diameter of ditto.....	$1\frac{7}{8}$ "

The "Wigham" and Douglass lighthouse combination lamps are forms of compound argands. Of regenerative gas burners, "their name is legion;" and for the distinctive features of the various patents, the reader is referred to abstracts of specifications appearing from time to time in the *Journal*.

These lamps, the main principle of which was noted in the previous chapter, were invented and introduced by Siemens. The original patterns were, however, somewhat cumbrous, complicated and expensive; but since then the lamp has been much simplified. In Sugg's "Cromartie" and like series, the Wenham, Meteor and other patterns, the burner orifice is downwards; and the flame—issuing somewhat like that of an inverted argand—is deflected by a center plate of porcelain or other material, and passes upwards towards the interior of the lamp; the gas and air supplies being contained therein in separate chambers or

pipes, and being intensely heated by the flame below and the products of combustion. An air-tight glass shade around the flame prevents the access of any air other than that supplied through the proper channels. Suitable regulators are fitted on the gas supply pipe, to enable a ready adjustment of the gas supply to the capabilities of the burner. The "Vertmarche," Diemel, Bower, Fullford, Fourness and other lamps have an ascending flame, which is, however, in some, but not all of those named, in like manner deflected into the interior of the lamp. The details of the gas and air supply arrangements, of course, differ in the various lamps; and they are, on the whole, highly ingenious and effective. The Schulke lamp and the improved Siemens embody all the foregoing advantages of heating the air and gas supplies; but they are much simplified in construction, by the employment of flat flames in lieu of the circular form, in the combustion chamber. Needless to say, the objections already advanced in reference to ordinary flat flames do not apply to these inclosed burners; and they are remarkable alike for their efficiency and simplicity. Of open gas lamps which partially employ this principle, by intensely heating the gas, and shielding the flame from the upward currents of air, may be enumerated the "Shaw," "Radiant," "Clapton," "Stott-Thorp Reflex," and others—suitable reflectors aiding in the effective duty; also Bray's ventilating gas lights and Sugg's well-known ventilating sun burners.

Carbureter lamps, as their name implies, employ enriching material which is taken up by the gas on its way to the burner; the light being thereby intensified. The well-known albo-carbon lamp is of this type. It consists of a reservoir containing a solidified hydrocarbon (naphthaline), placed near to or over the gas flame. The gas supply pipe is so arranged as also to be intensely heated by the flame. The solid hydrocarbon then, heated by the hot gas passing through it, as well as from the flame direct, becomes vaporized, and a portion of it is taken up by, and travels continuously with, the ordinary gas to the burner. A regulator enables the consumer to adjust the amount of the enricher going forward to the capabilities of the burner.

Lastly, the bunsen or atmospheric burner, giving a blue non-luminous flame; but this has already been briefly described. The following remarks from "Coal Gas as a Fuel," by Mr. Thomas Fletcher, F.C.S., are of interest:

Data of the Construction of Atmospheric Burners.—All atmospheric burners depend on three parts, which must be in definite proportion to each other. Any alteration which reduces the capacity or power of any one of these parts reduces the whole power of the burner in proportion. These points are: The size of the gas outlet, the diameter and length of the mixing tube, and the area of the outlet for burning the mixture. Approximately, the diameter of the outlet in the gas nipple must not exceed one-eighth of the diameter of the tube for 16 or 18 candle gas. The length of blank tubes for mixing must not, in horizontal burners, be less than five times the bore, and in vertical burners eight times the bore. The total area of outlets, either of holes or gauze, must not exceed the area of the tube itself. Approximately, the gas outlet for 30-candle gas requires to be three-fourths of the diameter, and for 60-candle gas one-half the diameter of that required for 18 candle gas.

Heating Power of Gas and of Burners.—The English standard unit of heat is the amount necessary to raise 1 pound of water 1° F. Ordinary 16 candle London gas has a power of about 660 units of heat per cubic foot. Therefore the heat which can be obtained from 1 cubic foot of London gas will heat 660 pounds (66 gallons) of water 1°, or will raise 4½ pounds, or rather more than 3 pints, of water from 52° to boiling point. This is the standard by which all heating appliances are judged, and the nearer their efficiency comes to this the better they are. Very few will give the total heat in useful work, and many appliances in use give far less than half. One gallon of water weighs 10 pounds; and theoretically 1 cubic foot of gas should heat this 66° F. Many bath heaters will heat one gallon of water 60° or more for every cubic foot of gas consumed. This at once gives as the gas consumption for a 30-gallon bath heated from 50° to 110° F.—*i.e.*, 30 cubic feet. Returning to ordinary pans, where about two-thirds of the theoretical duty can only be expected in practice, we can at once select the correct burner to boil any quantity of water in any given time. As an example, if we wish to boil 30 quarts of water in one hour, we must select a burner consuming 30 cubic feet of gas per hour. If the perforations or outlets in the burner are, as a total, equal to the circular area of the tube in which the gas and air mix, the average consumption at day pressure (10-10ths of an inch) will be about 24 cubic feet of gas per hour for every circular inch area of the tube. By the same rule, a ¼inch tube burner will consume 6 feet per hour; a ½-inch, 13½ feet per hour; and a 2-inch, 96 feet per hour.

The Gas Rate in San Francisco.

The following interesting matter respecting the proposition to revise gas rates in San Francisco recently appeared in the San Francisco *Call:*

The proposition which is being entertained by the Board of Supervisors of this city and county to reduce the present cost of gas to consumers is one that involves such serious consequences to the Gas Companies that they have been justified in the energetic protests which have been made by them against the adoption of such an ordinance.

The Gas Companies claim, and are prepared to demonstrate, that, taking into consideration the cost of the materials which enter most largely into the manufacture of illuminating gas, this city, in comparison with other great cities of the country, really pays less for this comfort or luxury than any of them, notwithstanding the fact that in some cities of the Union the price paid for gas by the general public does not exceed $1.25 for each 1,000 cubic feet.

To establish this proposition it is only necessary to compare the cost of coal, oil and pipe paid by the Eastern gas manufacturers with those paid by our local Companies, and the vast advantage which the Eastern Companies enjoy over our own in these respects will convince even the most skeptical.

The figures presented are official and cannot be disputed. They have been given in response to and at the urgent request of the President of the San Francisco Gas Light Company for information, and are accessible to every person who has the least doubt as to their reliability or who may be interested in the question as to whether San Francisco is or is not paying an extravagant rate for its gas. The information was also obtained for the purpose of enlightening the Board of Supervisors upon the cost of manufacturing gas and also of enabling them to understand the position of the Company in the premises and of assisting them in a just determination of the equities of the Gas Company and its consumers.

These figures have been obtained from all the large cities of the Union and are on file at the office of the San Francisco Gas Light Company, but as they all without exception indicate the great disadvantage of the local Companies in the purchase of material, some in a less and others in a higher degree, it is not thought to be necessary to quote all of the results obtained, but to cite a few only of some of the larger cities, whose transportation facilities and accessibility to the sources of supply would place them on the most favorable footing for the manufacture of cheap gas.

Comparison of Figures.—Taking San Francisco as a starting point, there was furnished during the past year 938,000,000 cubic feet of gas for actual consumption, at a cost to the consumer of $2 per 1,000 feet. The cost of anthracite coal used was $7.50 per ton, and of the bituminous $6.50 per ton. The oil consumed was of State production and cost 7.17 cents per gallon. These prices, owing to the dull times existing in every branch of production, are lower than the Gas Company has paid in some years. Compared with San Francisco are the figures supplied by the New York Companies: Total gas consumed, 7,000,000,000 cubic feet; cost of anthracite coal, $3.65 per ton, and of bituminous, $3.75 per ton, while for oil New York pays 2½ cents per gallon, or a difference against San Francisco of 104.50 per cent. on the cost of anthracite coal, 73.3 per cent. on bituminous coal, and 186.6 per cent. on the cost of oil. The price for gas in New York is $1.25.

Chicago manufactures 3,946,0000,000 cubic feet of gas per year, for which the consumer pays at the rate of $1.20 per 1,000 feet. Anthracite coal costs in Chicago $4.40 per ton, and the oil used 1.78 cents per gallon, so that San Francisco pays 70.4 per cent. higher than Chicago does for its anthracite coal, and no less than 302.9 per cent. higher for oil.

Philadelphia manufactures 3,400,000,000 cubic feet of gas yearly, for which the consumer pays $1.50 per 1,000. That city pays for anthracite coal $4.10 per ton, and $3.49 for bituminous. The oil used costs in Philadelphia 3 cents per gallon. Compared with Philadelphia, San Francisco pays 82.9 per cent. more for anthracite coal, 86.2 per cent. more for bituminous, and 139 per cent. more for oil.

Boston makes 1,275,000,000 cubic feet of gas per annum, and charges $1.30 per 1,000 cubic feet. It pays for anthracite coal $4, and for bituminous $3.75 per ton. That city pays 3.87½ cents per gallon for oil, so that San Francisco has to pay 104.5 per cent. higher than Boston for anthracite, 73.3 per cent. more for bituminous, and 85 per cent. excess on oil.

Cincinnati, a city of about the same population as San Francisco, sells 1,076,000,000 cubic feet of gas yearly, for which it charges $1.25 per 1,000. It uses only bituminous coal in its manufacture, which costs

$2.52 per ton. San Francisco thus pays 157.8 per cent. more for bituminous coal than Cincinnati.

The figures given above convey a general idea of the results of the careful inquiries instituted in order to learn the cost of material used in gas manufacture in all the great Eastern cities of the United States as compared with San Francisco, and the result from them all is substantially the same, the percentage against this city always ranging high.

Prices of Iron Pipe.—In the matter of iron pipe, the excess of its cost in San Francisco as compared with Eastern cities is fully 50 per cent. greater.

With these immense percentages against it on every one of the essential articles required in the manufacture of gas in San Francisco, it would seem evident to everyone who will take the trouble to consider the subject that it would be an absolute impossibility for the local companies to furnish gas at Eastern rates, or to even reduce existing prices. This coast has as yet developed no mines of anthracite or bituminous coals that can supply the quality that now is procured from Wales and Australia. The distance coals are conveyed necessitates keeping an immense stock on hand at all times, so as to be independent of the contingencies or casualties of the sea. There are no stocks upon which to draw in the event of a shortage as Eastern companies can do, and this item of interest alone on stocks carried is large and at present impossible to reduce.

Our Oil Wells a Relief.—In oil alone this market is practically independent of the East, and yet a comparison with prices paid by Eastern companies for this essential article shows the enormous advance local gas manufacturers have to pay as compared with their Eastern competitors. Yet the Company in San Francisco has left no stone unturned in order to cheapen the cost of gas by reducing the price of the articles from which it is manufactured.

The whole western slope has been explored for a supply of suitable coal and oil, and various projects have been considered for a reduction in freights, but so far without success; and for the present at least it appears that the old sources of supply must be relied upon until new discoveries shall change for the better existing conditions.

The New Improvement.—With gas reduced to $2 per 1,000 feet it would have been difficult, at the prices paid for oil, coal and other materials, to have continued dividends to stockholders with the old facilities of the Companies. If the stock was to be a continuously paying one, it was absolutely necessary that the works should be extended, and that every mechanical device for producing gas cheaply should be made available; consequently the old works at First and Howard streets were abandoned, and the new ones at North Beach were erected. These commenced operations in December, 1892, and rank as the most improved and complete in the United States.

Great Sums Expended.—This improvement and collateral ones have cost the Company thus far over $1,000,000. A further outlay of $500,000 will have to be expended before the works can be called complete. This $1,500,000 has been raised on the securities of the Company and must be provided for by the disposition of the lands on Howard street and other available properties owned by the Company, and which will be disposed of as soon as values become settled and a demand exists for this class of real estate. The improvements made at North Beach have necessitated extensions of pipe lines and connections which have involved a large expenditure for material and labor. One of these pipe line extensions is notably that from the works to the junction of Van Ness avenue and Market street, consisting of 13,000 feet of 24-inch iron pipe, and supplying the entire western portion of the city with gas. Other connections have been made throughout the western division that the rapid advancement of that section has rendered necessary. All of these new lines are not profitable to the Company, and many of them will not be for years to come, but the convenience and comfort of the people of these newly inhabited and growing sections had to be considered, and the Company willingly went to the necessary expense, even though a profitable return on the investment could not be looked for for years to come.

The Great North Beach Plant.—The improvements made at North Beach are notable, and rank among engineers of the country as the finest plant for the manufacture of gas in the world. Only recently an expert from Paris arrived in this city, having journeyed from the World's Fair for the express purpose of inspecting them. The opinion of the expert was "that they were admirable and were surpassed by none in the world." These improvements cover a large tract of land on the water front, a considerable proportion of which had to be filled in, and upon which the Company is constructing wharves, so as to reduce to the minimum the cost of the handling of those bulky products of which it consumes so much. The great gas tank, which holds 2,000,000 cubic feet, is the largest in the United States west of Chicago, and all of the other structures on the ground are built just as substantially and with an eye to the future wants of the community.

The Future Provided for.—The San Francisco Gas Light Company was compelled to make these extensive improvements not only on account of present needs, but to provide for future requirements. If only the present was to be considered, not one-third of its outlay of $1,500,000 would have been necessary, neither would it have been obliged to mortgage its real estate in order to raise the money for them, but this vast obligation was made inevitable on account of future contingencies. The city promises to experience a growth in the near future that will compass any in its history, from a straggling community of 300,000 souls, occupying an area quite as great as that peopled by 1,750,000 inhabitants of Manhattan Island. Every year witnesses a growth in the compactness of the city, and the time is not distant when every available acre in the city and county will be as closely built as is now the Mission and neighboring districts. The question of future growth had also to be practically considered, and in grasping this problem the Company has been compelled to make improvements and extensions from which it cannot hope to realize an income for years to come. With the works at the Potrero supplying the southern and western districts, and those at North Beach, the capacity of the plant is 8,000,000 cubic feet per day, which is over three times as great as the actual present daily consumption.

Voluntarily Reduced.—Heretofore the reductions made in the price of gas have been voluntary, and not through the action of the Board of Supervisors.

In the early days $15 per 1,000 feet was charged, and from this extreme figure rates have been gradually reduced until the minimum of $2 was reached.

Competition to Fix Rates.—The present low rate has been reached by the keenness of competition to which the Company has been subjected, and this competition instead of resting is becoming more keen and daily more formidable. Any intelligence can comprehend the astonishing growth of the electric light interest and how rapidly it has displaced and is displacing the most profitable sources of income that the Gas Companies possess. The future promises an indefinite growth in the use of the electric light and the consequent decrease in the use of gas. In order to reclaim its patronage the Gas Companies are compelled not to overcharge. They must meet this competition, and in this conflict between gas and electricity the private consumer and the public have the best assurance against excessive rates. Competition to the Gas Companies is not alone from electricity, but from numberless designs for reducing consumption and from the erection of portable gas machines which produce an appreciable decrease of revenue and have to be considered as live and energetic factors.

Financial Questions.—The capital stock of the San Francisco Gas Light Company is $10,000,000, which is its only liability outside of the $1,500,000 borrowed to make recent improvements. Upon this stock, which is quoted at from 68 to 70 per cent., it pays a dividend of 4 per cent. upon its par value. Its stockholders number nearly 1,000 and embrace holders of from one share upward. Much of the stock is held by the dependent, who would experience a serious loss in the event of a curtailment of their income, and who would be subjected to great hardship should dividends cease altogether. Should rates be even partially reduced the Company would be compelled either to reduce the present small rate of dividends or cease paying them altogethe, and in that case the result would be most disastrous to the majority of the holders of the stock.

Whether or not an impression exists that the stock of the Company is held in large blocks by wealthy stockholders, such an impression would be a greatly mistaken one. It is a fact that no one stockholder owns sufficient stock in the Company to enable him or her to dictate as to the appointment of a single Director.

Reducing Labor Wages.—The most serious effect of a curtailment of the Gas Company's income, by a reduction of the rates, would be the necessity which would be forced upon it of economizing to the last degree upon every item of expenditure, and the first reduction made would be in the matter of labor, which represents the largest single item on the debtor side of the books. The San Francisco Gas Light Company employs at all times not less than 600 men, whose wages range from $2 a day for the common laborer to $3.50 and $4, and even higher for the expert. By far the common laborer is in the majority, and any reduction from his $2 per day means a curtailment of his ordinary comforts which it is difficult to realize. The Company has maintained these wages even when employing a greater number of men, and when men

who were anxious to work would voluntarily offer to labor for less money. It pays out now $40,000 per month for this item alone, or $480,000 per year. It aims to pay fair wages, and believes that the men earn all that they get, but a reduction of revenue would compel a reduction of wages, a contingency which would be regarded by every officer of the Company with regret.

Loyal to California.—The San Francisco Gas Light Company has ever been loyal to the industrial interests of the State. Almost the entire amount of the $1,500,000 expended and to be expended in recent improvements has been spent here. The works at North Beach have been constructed of California material and by California labor. The men of the Union Iron Works and Pacific Rolling Mill erected the great tank and forged every bit of iron which is in the work. Nothing was imported that could by any possibility have been produced here, and by all precedent the Company deserves fair treatment, and only asks for an opportunity of proving to the Board of Supervisors that the figures which it has submitted can be verified and that any reduction from the low present rates would be disastrous to its stockholders and employees and unjust to all concerned.

Coal Mining in the First West Virginia District.

From the annual report of D. M. Harr, Mine Inspector of the First District, West Virginia, relative to the mining industry of that district for the year ending June 30, 1893, we make the following extracts:

The year has been fairly active among the mines in the district, notwithstanding the financial stringency and the demoralization of the coke market for several months past, the production of coal being largely increased over last year, and there being also a slight increase in the quantity of coke manufactured. The strike of last summer almost ruined for the time being the coal and coke industry in Brooke, Ohio and Marshall, and was very injurious to production in Marion county. The production of coal in the district for the year was 2,762,970 tons, as against 2,427,662 tons last year, an increase of 335,308 tons; and the production of coke was 364,373 tons, an increase of 16,148 tons over last year, when the production was 348,225 tons of 2,240 pounds.

In Marion county the total production of coal last year was 993,866 tons, and this year shows an increase of 54,400 tons; making a total production of 958,296 tons. There was a slight falling off in the coke production.

There were no explosions of firedamp in the district during the year. During the year there occurred in the district 12 fatal accidents and 38 non-fatal accidents.

There was one life for each 230,248 tons of coal produced, and one non-fatal accident for each 72,710 tons. The average annual earnings per miner was $470.25 throughout the district. There were 2,644 miners employed, 855 laborers and 381 coke workers; making a total number of men employed about the mines of 3,880. In addition to the mines reported, there are in the district a large number of small mines, employing less than 10 men each, which do not come within the purview of the law. The production of these mines cannot be reliably estimated, but it is considerable, especially in the fall and winter season.

One mine, Mountain Brook Shaft, at Newgurg, Preston county, has been abandoned, and seven new ones have been reported, viz.: Glendale Mine, in Marshall county; King, in Marion; Blanch, in Brooke; Briar Hill and Findlay & Whitehead, in Harrison; Thomas Shaft, in Tucker, and Pierce, in Mineral. Since the end of the year another new mine has been opened by Hutchinson Bros. on the M. R. R. R. near Worthington, in Marion county.

All of these mines have been opened on about the usual safe lines heretofore in vogue in the district, and the only one requiring special notice here is the King Mine, near Benton's Ferry, on the B. & O. Railroad, operated by the Virginia and Pittsburgh Coal and Coke Company. The company has here the Bleishert method of transporting coal across the river by means of a wire rope tramway and buckets, which is both economical and effective.

A fire at Montana destroyed the tipples, boiler and engine house, washer, crusher, and in fact all the machinery and appliances, but the buildings destroyed have all been replaced with later, larger and better structures, and new and improved machinery has been provided.

A very largely increased production is hoped for and confidently expected during the present year. Business is good at present all over the district, the demand for coal being equal to the supply, and the demand for coke having recently materially improved.

A table showing the production in Marion county, West Virginia, for the year ending June 30, 1893, is appended:

Name of Mine.	Coal. Tons.	Coke. Tons.	Ovens.	Employees.
Aurora	33,350	.....	..	46
Central	12,633	2,584	10	41
Clements	32,000	21,000	45	63
Gaston	156,945	29,031	90	220
Monongah	356,027	61,286	323	590
Montana	162,620	60,854	158	390
Palatine	45,439	.....	..	51
Prichard	30,793	2,329	12	53
King	25,275	.....	..	28
West Fairmont	103,214	16,360	36	122
Totals	958,206	193,444	674	1,514

SPECIAL ENGLISH CORRESPONDENCE.

COMMUNICATED BY NORTON H. HUMPHRYS.

SALISBURY, October 10, 1893.

The Coal Strike.—Consolidated Coal Interests.—Cost of Coal and Price of Gas.—Professor Lewes on Substitutes for Coal.

The dispute in the coal trade has now assumed important proportions as regards our national welfare, having proved much more bitter and determined, both on the part of masters and men, than was at first supposed to be the case.

Although in many districts the miners are at starvation point, the large funds which they had accumulated in their various societies as a provision against emergencies such as the present, being utterly exhausted, and thus leaving them dependent upon public charity for daily bread for themselves and their families, they still obstinately refuse to entertain anything in the way of a reduction of wages, or any mode of settlement such as arbitration, that involves even the possibility of such being made. The only reason advanced for this decided course appears to be the assertion that the present rate is only a "bare living." The facts that the majority contrived to live comfortably before the increases of 1888 and 1890, and that they have accumulated large funds in their societies, at once disposes of this objection. No doubt that if we could all take the fixing of our own incomes, they would be set at a higher figure than at present, but the system is utterly unsound and would not last. So this attempt on the part of the miners to fix an arbitrary wage rate is bound to fail in the end. But the men cannot fairly be blamed as the sole cause of the present deplorable state of affairs. When the owners agreed to go bluntly to the men and demand the acceptance of a reduction in wages amounting to nearly 20 per cent., they must have been aware that they were precipitating a gigantic struggle. They probably anticipated the consequences as respecting their own interests, and arranged accordingly. Meanwhile the consumer is forced to pay for all this quarreling. Stocks are getting low, cold weather is setting in, and the poor man who needs artificial warmth for his household cannot secure it at less than 2s. per cwt. for coal. All our industries are suffering, thousands and thousands of men are out of work, and unless the signs of the end of the struggle, which now appear to be heaving in sight, are rapidly realized, there will be a real necessity for government interference.

As regards the effect upon the works of gas companies, the excessive demand for fuel of any kind is leading to the diversion of gas coals from their legitimate sphere, to steam raising and general uses. This renders them scarce, and creates difficulty in the way of securing proper supplies. In fact the trade seems demoralized. With the exception of the few pits continuing at work, all contracts are at a standstill, according to the "strike" clause inserted in all these agreements. It is necessary to buy from hand to mouth, and even when arrangements for delivery are made, no dependence whatever can be placed upon such being carried out. The almost entire cessation of railway traffic in some districts, and the increased pressure in others, has unhinged the conveyance of coals to such an extent that even if the despatch from the colliery is prompt, the cargoes are kept several days on the way. And this applies equally to coast traffic by sea. Within the last few days a rise of prices equivalent to about 20 per cent. has been declared, but there is no likelihood that it can be maintained for many days. At this time of year, however, stocks must be kept up. The coal market will be in a most unsatisfactory condition all the winter, and especially about Christmas time. So coal must be bought at present prices, and the advisability of an immediate rise in the price of gas is being seriously contemplated by many boards of management, for it is bad policy to wait till after the bother is over and then ask for a higher price. One or two increases have already been announced.

It is rather remarkable that a bold and elaborate proposal should be ready to be launched just at this time, as a means of satisfying all concerned, and preventing a recurrence of this great national disaster—it is nothing less—which will remain as a feature of the year 1893. If the miner is to receive higher wages, the owner larger profits, and the public cheaper coal, it is evident that there must be a large saving in working expenses as per ton of coal handled, and one is anxious to know where this saving will come in. The scheme proposes nothing smaller than the amalgamation of the whole of the coal mines of the country into one gigantic joint-stock company, with a capital of about 120,000,000 sterling. Such a combination would, it is claimed, open the door to many economies in the raising and delivery of coal, that are, under present ways of working, impossible of attainment. It is quite obvious that where a number of collieries adjoin one another, each occupying an irregularly shaped area of ground, the whole would be worked under one management to greater advantage than with each worked distinctly. The arrangements for ventilation, pumping out water and lifting coal could be carried out after a systematic plan. Considerations of space do not admit of entering into details of the means that are claimed to be capable of bringing together mine owners, coal merchants, miners and users of coal into one happy family, but the scheme is advanced in good faith, and an attempt is to be made toward carrying it out. The purchasers of coal must remember that in addition to the orthodox version of the lion and the lamb lying down together, there is another and far more general way in which that apparently desirable result is obtained, and that is when the lamb is inside the lion. Let us hope that the "Consolidated Coal Interests, Limited," will not prove a lion. Time will show whether it is really an outcome of the present situation, or if, on the other hand, its inception is in any degree responsible for bringing about the present state of affairs.

Increased prices of coal are always followed by the partial compensation afforded by a rise in coke. The extent of this compensation is frequently exaggerated in outside quarters, and some go so far as to say that in practice the one balances the other, and that whatever the gross cost of coal may be, the net cost always works out to an inconsiderable amount. This argument amounts in effect to the assertion that gas practically costs nothing, and that the gas rental is all profit. Unfortunately, such a supposition is very far indeed from the truth. In the first place, coke cannot be made to follow in the footmarks of coal fluctuations. No gas manager in his senses would take the price of coal as a standard for regulating the price of coke in anything more than a very general way. Coal was put up 3s. per ton last week, but if at any gas works the price of coke has been raised to an equal extent it is only because that works is very exceptionally situated. Coal certainly does react upon coke, but only in a smaller way; and in practice about one-half of the increased rate may be placed on the coke. If coal goes up 5s., coke may be raised about 2s. 6d. But in the second place, the quantity of coke remaining for sale is only about one-half the weight of the coal, which means a second halving. So far from fully compensating, the coke only returns about one-quarter of the increase.

As to the other residuals, tar is but little affected by the price of coal, and ammonia not at all. The claim that high coal prices have no important effect upon the working expenses is simply a gross misrepresentation, as at least 70 per cent. of the rise is directly chargeable to them. Lastly, the cost of coal at the gas works has averaged 12s. to 15s. per ton, of which 7s. to 9s. is returned by the sale of the products, leaving the net cost at 5s. to 6s. An increase of 5s. per ton means 17s. to 20s. per ton gross, and 8s. 6d. or 9s. 6d. net, leaving 3s. 6d. per ton additional to be charged to the gas, which is equivalent to about 4d. per 1,000 feet sold. So it is evident that the cost of coal must always be an important feature in determining the selling price of gas.

Coming amidst circumstances such as those just related, a paper read before the Society of Engineers last week, by Prof. Vivian B. Lewes, is especially worthy of notice. The title of the communication was "Gas Substitutes," and it dealt with the various methods that have been proposed from time to time as improvements on the ordinary retort system of coal distillation. These processes were classified under the headings of oil gas, air gas and carbureted water gas, titles that are sufficiently distinctive without further explanation. Speaking of the first class, the author referred to the Pintsch and kindred systems of retorting oil, and also to Mr. W. Young's process; as examples of the second he mentioned the albo-carbon, the Maxim-Clark and the Tatham oxy-oil gas methods of enriching poor gas; and the Lowe, Springer, Loomis, Flannery and Van Steenburgh were instanced under the third heading. Finally he described the process known by his own name, which is an outcome of an endeavor to combine the practical advantages of lightness and absence of a large proportion of carbonic oxide, which are the special advantages of ordinary coal gas, with rapidity of production, facility for regulation of quality, and other benefits that are peculiar to the generator system. He aims at producing gas from any of the materials suitable for the ordinary cupola, of such quality as to approximate in respect to specific gravity to ordinary coal gas, and these admit of being applied in any proportion, as convenience of working may dictate, to any coal gas district. In addition to an ordinary generator, he uses chambers or superheaters packed with iron oxide. The blast from the generator is caused to traverse through the oxide, and the carbonic oxide is converted into carbonic acid, thereby reducing the iron to the metallic form. This reaction is attended with the production of heat, and the material is raised to a high temperature. The opening to the chimney is then closed, steam is injected into the generator in the usual way, and also into the chambers packed with iron. The result is that the steam is decomposed, oxide of iron being again formed, and pure hydrogen passing off. So this process produces a compound of gas, comprising pure hydrogen, water gas and oil gas, which contains not more than 15 per cent. of carbonic oxide and no appreciable proportion of nitrogen. The special feature is that no air is used for making the gas, and that a large proportion of the oxygen from the steam is left behind and transferred to the waste gases. The process is worked in runs as usual with cupola systems, and the heating up of the coke or anthracite is concurrent with the reduction of the iron. The reading of the paper was followed by an interesting discussion, in the course of which some of the views advanced were freely criticized.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE following letter explains itself:

ASTOR HOUSE, NEW YORK, Oct. 12, 1893.

To the Editor AMERICAN GAS LIGHT JOURNAL: In reading your valuable JOURNAL of October 9th, I find an article on the Port Huron Fuel Gas and Light Company, evidently written by a friend of the Port Huron Gas Company, and had the writer confined himself to the truth, which he has not done in one single statement regarding the new Company, I at least would have taken no notice of it; but the gross injustice it does to the Company, of which I served as General Manager, from December, 1892, to September 15th, 1893, when I resigned, to associate with Captain Archer in his extensive gas plant business (as understood by the Company when I assumed its management), calls for a few facts from me. First, I spent for the Company during my administration, in building for the works a gas house 34 feet by 64 feet, and putting into it foundations for J. B. Archer's improved system for making illuminating and fuel gas, and for engine, boiler, oil tank and other work, over $20,000—not for a little holder and some second hand machinery, as stated by your correspondent. Second, the Company is composed of Pittsburgh, Pa., business men, and a large majority of the stock is owned by them; it has no bonds. The stock represents the Company, and its holders own the plant. The Company, which is to pay Captain Archer in stock for his plant, is practically out of debt, and is not even offering for sale any of its $50,000 of treasury stock. The Company's franchise from the city of Port Huron makes the price to be charged for fuel gas not to exceed 50 cents per 1,000, and for illuminating gas $1.25 per 1,000 cubic feet, and the Company is perfectly satisfied with the franchise—the old Company has been charging the citizens about $2 per 1,000, with a discount to some, and has passed some dividends at that. The plant when completed will have a capacity of 1,000,000 cubic feet per day, and it will be a model one in every particular. Third, if it is to be a gas war, and the old Company will furnish the city with a gas having as many heat units and as high a candle power as the gas furnished by the new Company, and will sell it at a price as low as the new Company can and still earn dividends, the city of Port Huron will have the cheapest and best gas in the world. Yours very truly, F. E. SUMNER.

THE authorities of Le Roy, N. Y., have ordered that on and after November 1st the incandescent electric lights now lighting the village streets shall be discontinued, they to be replaced by the gas lights formerly used. The Gas Company has offered to supply all the gas needed at the rate of $2 per 1,000, with a discount of 10 per cent. for payment of bills within 10 days from the date of their rendering. We understand that this rate will also apply to all gas consumed in the village on private account. The old schedule called for a gross payment of $3 per 1,000.

THE Berlin Iron Bridge Company, of East Berlin, Conn., has received the contract for the new drawbridge at Salem, Mass. The structure will have a 60-foot opening, with a roadway 28 feet wide in the

clear, and two sidewalks, each to be 6 feet in width. It is to be of deck plate girder construction.

MR. G. W. BENEDICT, writing to the JOURNAL under date of October 14th, from Liberty, Ind., propounds the following query, which we submit to our readers, in the hope (faint and weak the hope is) that some one of them can point the way, for we are unable to do so :

To the Editor AMERICAN GAS LIGHT JOURNAL : Is there to your knowledge a gas making system which will produce a gas of 22 candle power and equal natural gas for heat energy, that can be made from 5 gallons of crude oil, sp. gr. .43, and 10 lbs. of block coal per 1,000 cubic feet. If you know of a system of this kind, please do me the kindness to give particulars.

THE famous Harris gas plant at Connersville, Ind., is as silent as the grave, and the Harris system generally appears to be in an equally somnolent state.

THE proprietors of the Company which controls the supply of natural gas at Connersville, Ind., have increased the service rates to $2.75 per month for each cook stove, and to $3.25 for each heater. The old rates were $2 and $2.75 respectively.

THE proprietors of the Rushville (Ind.) Natural Gas Company have about decided to introduce the meter system.

THE United Gas Improvement Company has done a very sensible thing in opening a branch office for the payment of rates, etc., in the district of Jersey City, N. J., known as the Heights. It is located at 116 Monticello avenue.

JUDGE LUMPKIN recently signed an order in the case of the Atlanta (Ga.) Gas Company against the city of Atlanta. From the petition of the plaintiff it appears that when the Gas Company was originally established the city subscribed for stock in the enterprise to the amount of $20,000. The stock was paid for in city bonds bearing 7 per cent. interest. The city also agreed to exempt the Company from the payment of taxes. Subsequently the city sold its interest in the Company, and later on chartered an opposition Company, which our readers will remember was known under the title of the Gate City Gas Company. When the rate war between the contestants was settled by a consolidation of the conflicting interests, the authorities claimed that the consolidated enterprise was liable to taxation, a contention that the gas proprietors stoutly resisted. A suit was brought—the city assessing the property for purposes of taxation on the basis of $200,000—we think in 1889, to determine the question, and this has dragged along in varying stages, or until the order entered by Judge Lumpkin. The Company finally compromised the case by agreeing to pay back taxes for the years 1890, 1891, 1892 and 1893, on a valuation of $175,000, such valuation to stand until 1905, provided no additions to buildings or enlargement of real estate holdings are in the meantime made.

ADVICES from Canandaigua, N. Y., dated October 13th, are to the following effect : "Lyman C. North, President of the Board of Trustees of the village of Canandaigua, and Superintendent of the Canandaigua Gas Company, died at his home on Park street on the afternoon of October 10th. Mr. North had been confined to the house for about two weeks, his death resulting from a chronic disease of the bowels from which he had been a severe sufferer at intervals for several years, and which seemed to have been aggravated by injuries received in a runaway accident in April last. Lyman C. North was born in East Bloomfield, N. Y., in 1832, and was still a resident of that town when he married Miss Susan A Crandall, of Olcott, Niagara county. He removed from East Bloomfield to Nashville, Tenn., in 1868, remaining there for four years. In 1872 he became a resident of Olcott, and in 1874 he came to Canandaigua to assume the post of Superintendent of the gas works, a position which he filled at the time of his death. He was a practical mechanic, thoroughly acquainted with the manufacture and distribution of gas, and a competent business man, wherefore the Company in his death loses a most efficient and faithful employee. Mr. North early won recognition in Canandaigua as a level-headed and capable man of affairs, and as an influential and enterprising citizen. Although affiliating with the Democratic party, he never took an active or aggressive part in politics, but in 1882 he was a nominee of his party for the office of Village Trustee and was elected by a flattering majority. He served acceptably in this trying position, and for the second year of his two years' term (1883) he was made the President of the Board. In 1892 he was again put in nomination for the office of Trustee, was again elected, and upon the organization of the Board was chosen as before to act as its President, a position to which he was re-elected at the beginning of the present year. As a member and President of the Board of Trustees he had the confidence and goodwill of the people to a notable degree and served their interests conscientiously. His death is widely and sincerely mourned. Mr. North was an honored member of Canandaigua Lodge, F. and A. M., and of Excelsior Chapter, R. A. M., having served as Master and High Priest of these organizations. He was also a member of the Empire Order of Mutual Aid. He leaves a wife and one son, Stanley C. North ; also two brothers, Elisha D., of East Bloomfield, and Horatio B., of Nashville, Tenn. The funeral services were held, under the auspices of the Masonic fraternity, at the Canandaigua Presbyterian Church, on the forenoon of the 11th inst., and interment was made in Woodlawn cemetery."

MR. FRED. SARGENT, for some time connected with the Lawrence (Mass.) Gas Company, has been appointed Superintendent of the works of the Montgomery (Ala) Gas and Electric Light Company.

MR. THOMAS MURPHY, Superintendent of the Fon du Lac (Wis.) Gas Light Company, has successfully drilled a 4½-inch artesian well on the works premises, which affords an ample supply of water for all the purposes of the plant.

AT the annual meeting of the Troy (N. Y.) Gas Company the following Trustees were elected : Edward Murphy, Jr., William Kemp, F. E. Draper, James Fleming, S. O. Gleason, George P. Ide, F. J. Molloy, William A. Thompson, Albert E. Bonesteel, A. N. Brady, A. Bleecker Banks and R. C. Pruyn. Mr. Bonesteel succeeds the late Joseph Fales.

A FEATURE of the October meeting of the Society of Gas Lighting was the presence of Dr. Buhte, the celebrated German gas savant, who has been "doing" the World's Fair for some weeks. The Doctor, who was elected an Honorary Member of the Society, leaves for home on the 19th inst., sailing on the Fuerst Bismarck.

A CORRESPONDENT at Stockton, Cal., forwards the following : "The work of enlarging and improving the generating and storage plants of the Stockton Gas Light and Heat Company is being pushed rapidly, and will be completed by December 1st. To appreciate the extent and cost of the work, one needs to know merely that the capacity of the plant has been increased in a manufacturing sense from 100,000 cubic feet to 300,000 cubic feet per diem, and that the most modern improvements have been incorporated in the plant in enlarging it. The retort house has been completely rebuilt and re-equipped, and an additional holder (the Company has three old ones in use) is being constructed. The three old holders have a combined capacity of 100,000 feet, whereas the new one will hold 200,000 feet. It is 90 feet in diameter, and has two lifts, each of about 24 feet in height, and it rests in a brick tank. Everything will be ready on the 1st of December for generating and storing 300,000 cubic feet of coal gas every 24 hours, and then Stockton will have the finest gas plant in the State outside of San Francisco and Oakland. As a matter of fact, it will be almost three times as large as the present needs of the city absolutely require, but the Company desires to have a reserve capacity, so that in case any of the machinery should break down the supply of gas would not be cut off. And then the corporation realizes that Stockton is growing fast, and is bound to grow still faster ; and it was thought best in making the improvements to provide at once for the future. An effort to increase the consumption of gas immediately is, however, to be made. Mains are being run to parts of the city which have heretofore not been supplied with gas, and the work will be continued until the rains prevent its further prosecution. The Stockton Gas Light and Heat Company always keep abreast of the times, and in pursuance of this policy it erected a few years ago a thoroughly equipped electric power house, which supplies the current for the street lights, both arc and incandescent, and also for the electric street cars. The Company also supplies consumers with natural gas from the Jackson and Convent wells, burning the surplus under its boilers. The corporation is one of the oldest of the town. The works were started by the Gallagher brothers, who sold out to Messrs. J. G. Eastland and C. W. Lightner. Henry Adams, Sr., who was then employed at the Oakland gas works by Messrs. Eastland and Lightner, was given the superintendency of the Stockton branch, a position he retained up to the time of his death, on the 19th of January last. His sons, Henry and Frank, were then appointed respectively Superintendent and Assistant Superintendent. Mr. J. G. Eastland is still President of the corporation, and the Secretary is Mr. A. T. Eastland.—A. M. D."

EARLY this month Judge McKenna, of the United States Circuit Court for the District, granted a temporary restraining order, at the request of the complainant in the case of the Pacific Gas Improvement Company against the city and county of San Francisco, the Mayor, Board of Supervisors and Superintendent of Public Streets and Highways. This action has arisen on account of the efforts of J. G. Fair to reclaim a large tract of land in that portion of the Bay of San Francisco, situated between what is known as the Presidio Reservation and Black Point. Through the efforts of Mr. Fair the Board of Supervisors, on July 17th, passed a resolution creating an assessment district and ordering the improvements made. For weeks the contractors have been actively engaged in carrying out the commands of the Supervisors, and substantial building lots are being created where heretofore the water of the Bay has held undisputed possession. The Pacific Gas Improvement Company owns a block of land on the shore of the Bay lying between Fillmore and Steiner streets, and upon the property the Company has constructed a landing place for vessels engaged in bringing to it coal and other supplies. If the improvement now in progress is completed the landing place will become useless, and in the place of navigable water there will be dry land. To prevent such a condition the Gas Company has asked for a perpetual injunction restraining the city or its officers from prosecuting the work, and the petition will be heard in the near future by Judge McKenna. Pending this hearing the work of filling in will be discontinued. The Pacific Gas Improvement Company in its bill in equity alleges that all of the land lying to the north of the block occupied by it has been and is still owned by the State of California, and is continually covered by the navigable waters of the Bay of San Francisco, and have always constituted a common and open public highway for vessels, and is now being used for the purposes of navigation and commerce; that the land was granted to the State under an act of Congress, which provides that all the navigable waters within the State shall be common highways and forever free; that the city and county are about to illegally convert into land an area of the navigable waters of the Bay equal to about 100 acres. The complainant also alleges that if any considerable part of the proposed work is done the tides and currents of the Bay will be so cut off and obstructed that the portion of it in front of the complainant's property will become shoaled and the navigability thereof permanently destroyed, and the injury to the Company's business and property will be irreparable. In conclusion, the complainant charges that the Mayor, Board of Supervisors, Superintendent of Streets and other persons at present unknown have combined to injure and oppress the complainant, and destroy that portion of the Bay described as a highway for vessels.

PROF. WILSON, inspector of gas and illuminating oils for the city of Baltimore, reports that the gas supplied by the Consolidated Gas Company of that city during the first week in October averaged in illuminating value 28.89 candles. This is pretty well in advance of the 20-candle power required by the local ordinances governing such matters.

A PLANT of the Pintsch type is being constructed at Portland, Me., for the supply of gas necessary for the lighting of the railway coaches of the Maine Central Railroad.

THE preachers and the physicians of Rutland, Vt., have inaugurated a movement having for its object a reduction in the local gas rate. At any rate when this topic was discussed there at a meeting of the Board of Trade many Divines and Doctors joined in the argument, and all agreed that the gas charges were excessive. The upshot of the session was the appointment of a committee (Messrs. Linnington, White and Quinn) to confer with the Company for "relief."

MR. ROBERT LONG, for many years works foreman of the Salem (Mass.) Gas Light Company, has been appointed Superintendent of the gas works on the United States Government military post, West Point, N.Y. We have no doubt that Mr. Long is fully up to the duties of his new position, but there is this to be said about the West Point berth. No man can make "a go" of it unless the "civil and military" engineers, who abound there, will permit the man in charge of the gas works to be in charge in reality instead of nominally. There has been too much of the latter at West Point altogether of late years.

THE following was forwarded by "Observer": "At a meeting of the Cambridge (Mass.) Common Council the joint Special Committee appointed to confer with the Cambridge Gas Light Company made its report. The report and order, which are appended, were adopted: The joint Special Committee appointed to confer with the Cambridge Gas Light Company to endeavor to secure a reduction in the price of gas consumed by the city report that they have given considerable attention to the subject, but were unable to bring the work to a close before the summer vacation, owing to delay on the part of the Company. Your Committee found that up to April, 1892, the price paid by the city was $1.60 per 1,000 cubic feet; from that date to April 1, 1893, $1.50 per 1,000 cubic feet, and from that time it has been $1.40 per 1,000 cubic feet, which was the price being paid by the city at the time of the first meeting of the Committee. It was found that the cost of gas consumed in the public buildings in the year 1892 was $5,014.02, which was equivalent to a consumption of about 3,300,000 cubic feet, at $1.50 per 1,000. In the street lamps for the same year the cost was $7,266.69. On May 15th a conference was held with the President of the Company with reference to a reduction in price, as called for by the order, but as he was about to leave the city for a time, he requested that the matter be delayed until his return, which was readily agreed to. On his return he again requested delay until early in September, on account of its being difficult to obtain a full meeting of the Directors during the summer months, and for other reasons, and to this the Committee also assented. A meeting of the Company was held, however, during the month of August or thereabout, at which the Company decided to reduce to all consumers from $1.50 per 1,000 cubic feet to $1.35, net, but no action was taken directly upon the request of your Committee until they finally requested a definite reply, when the Company, at its meeting held September 11, voted that the gas used in the public buildings occupied by the city be charged at $1.30 net per 1,000 on and after October 1, 1893. It appears by the Company's last published return (made at the close of business, June 30, 1892) to the Board of Gas and Electric Light Commissioners, that its profits for the year were very nearly 15 per cent. net, out of which it paid a dividend of 10 per cent., the balance being added to surplus. The reduction made by the Company as above stated practically wipes out the surplus earnings above the 10 per cent. dividend. Only 15 Companies in the State paid as high a rate of dividend as the Cambridge Company during that year, while 53 Companies paid a less rate, or nothing; and while the Cambridge Company is the sixth largest producer, 14 other Companies have in the recent past sold gas at a less average price. It is, therefore, the opinion of your Committee that a further reduction should be made, and they recommend the adoption of the accompanying order looking to an examination of the affairs of the Company by the Board of Gas and Electric Light Commissioners with reference to such further reduction." The order reads:

"*Ordered*, That his honor the Mayor be and he hereby is authorized and requested to petition the Board of Gas and Electric Light Commissioners to examine the affairs of the Cambridge Gas Light Company with a view to ordering a reduction in the price of gas in this city."

THE new holder for the Middletown (Conn.) Gas Light Company will insure a good pressure and supply in the South Farms district, which have hitherto not been at all up to the gaseous needs thereof.

SUPERINTENDENT HEINTZLEMAN, of the Penn Gas Coal Company's car shops, reports that the new shops will be completed by January 1st.

HERE is a waif from Tacoma that has a moral: "The present County Commissioners inherited from their predecessors an electric lighting plant located in the basement of the new County Court House, the efficiency of which must be proved before it can be accepted. It has been in operation for some time, but the trial must be continued still further before they will be able to decide definitely how much it will cost to operate the plant. In the meantime, however, they are satisfied that they can secure from outside sources an electric lighting service cheaper than they can maintain it from the basement plant."

THE Riverside (Cal.) Gas Company will make considerable extensions to its main system.

MR. NETTLETON'S Derby Gas Company, of Birmingham, Conn., will push the sale of gas heaters this winter. Several samples of heaters are displayed in the show windows of the Company's handsome offices on Elizabeth street, the heaters being in practical working order during a few hours each evening.

INSPECTOR WILLIAMS, of the Consumers Gas Company, of Toronto, has instituted suit against the City and Suburban Railway Company, of Toronto, for $20,000 damages for injuries received by the derailment of a car.

THE AMERICAN GAS LIGHT JOURNAL

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PROPRIETORS.

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VENTILATION, SANITARY IMPROVEMENT,
AND GENERAL SCIENCE

MONDAY, OCTOBER 23, 1893.

The Market for Gas Securities.

The market for gas shares during the week, while restricted and narrow as to actual transfers, was inclined to show decidedly higher figures. Consolidated sold up this morning (Friday) to 133, and 132¾ was freely bid afterwards. We look with confidence for much higher prices in it in the near future. Other city shares show no marked change, although it is safe to predict that better prices will be made in them. The Brooklyn situation remains practically unchanged; the snarling between the conflicting interests is quite pronounced, we are disgusted to be obliged to say. Equity bonds are bid for at 25. Chicago gas has had its usual ups-and-downs, and the "ups" have it to-day, the opening having been made at 60 bid. Baltimore Consolidated is strong, at 58¾ to 59, and Bay State is dull at 15¼. Boston United seconds are offered at 58. Laclede is very sluggish, both as to common and preferred, at 14¾ and 55, bid respectively.

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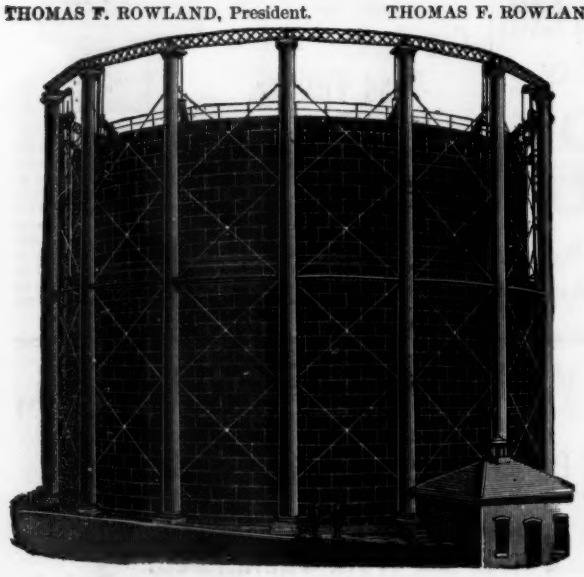

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Wrought Iron Gas Holder Tanks.

BENCH CASTINGS, RETORT LIDS.

Hydraulic Mains, Condensers, Scrubbers, Purifiers, Valves, Etc., Etc.

SELF-SEALING RETORT MOUTHPIECES & LIDS.

For Round, Oval, or "D" Retorts.

Reliable Gas Heaters, Parlor Grates and Radiators.

Three Distinct Lines.

Sixty Different Styles.

Ranging in Price from

$5.00 to $30.00.

Send for 1894 Catalogue of Heating Stoves.

New Designs and

Improvements for 1894.

The Largest and Most Complete Line ever Manufactured Under one Name.

The SCHNEIDER & TRENKAMP CO.,

Sole Manufacturers of Reliable Gas Heaters. **479-501 Case Ave., Cleveland, Ohio.**

Jewel Gas Heating Stoves
For 1893-94.

Send for Catalog of the Most Artistic Line of Heaters on the Market.

The New Double Reflector is Worthy of Attention.

22 Styles. Prices from $4.50 to $12.

GEORGE M. CLARK & COMPANY,

MAKERS,

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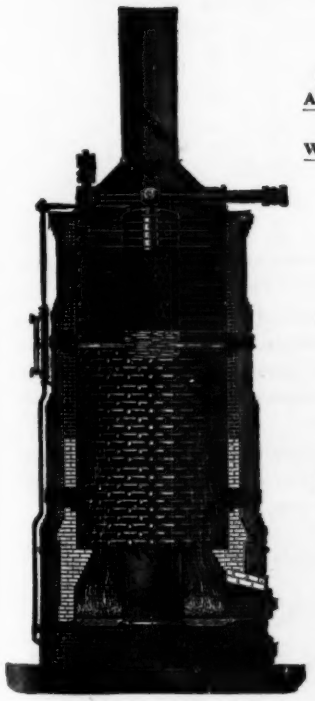
The HAZELTON BOILER Frequently Called The PORCUPINE BOILER

Patented in America and Abroad.



100,000 HORSE POWER

of this Justly Celebrated Water-Tube Boiler in Successful Operation in all the Principal Industries.
An Unparalelled Record, of Over Twelve Years, for Economy, Durability, Safety, and Efficiency.
A Common-Sense High-Pressure Boiler made in a Superior Manner.
We Solicit for it the Critical Examination of the Mechanical Profession and the Steam-Using Public.

THE HIGHEST STANDARD OF EXCELLENCE.

Standard Sizes, 50 H.P. to 500 H.P.

THREE REGISTERED
THE HAZELTON BOILER.

THE PORCUPINE BOILER.
TRADE MARKS.

Special Sectional Boilers For Export.

The only Genuine Hazelton or Porcupine Boilers bear our Three Registered Trade Marks.

∴ BEWARE OF IMITATIONS. ∴

This Company is prepared to Manufacture and Furnish Plants of Boilers of any desired capacity, and will forward proposals and other information on application. All imitations of the substantial features of this Boiler are infringements, and will be prosecuted to the full extent of the law.

THE HAZELTON BOILER CO.,

Sole Proprietors and Manufacturers, NEW YORK, U. S. A.

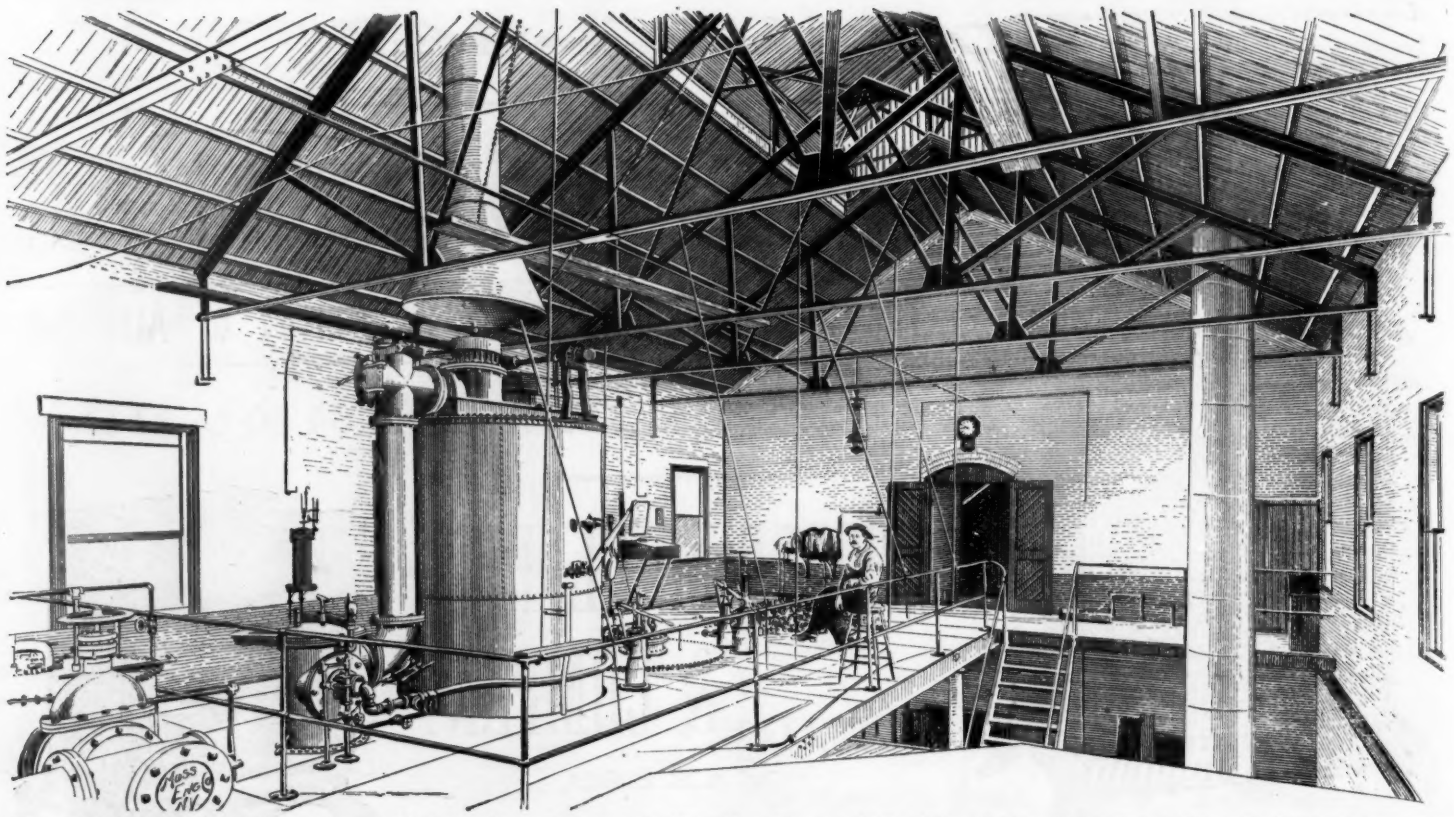
Cable Address, "PAILA," NEW YORK. **WRITE FOR ILLUSTRATED CATALOGUE. Correspondence Solicited.** **Long Distance Telephone, 1229-18th St., New York.**

This Boiler is producing unequaled results in the works of most of the principal Gas Co.'s of the U.S., and in similar plants in Foreign Countries

NOT CONNECTED WITH ANY OTHER CONCERN IN THE UNITED STATES

CHAS. M. JARVIS, Prest. & Chief Engineer. BURR K. FIELD, Vice-President. FRANK L. WILCOX, Treasurer. GEO. H. SAGE, Secretary.

THE BERLIN IRON BRIDGE CO.



The above illustration is taken from a photograph, and shows the Machine Room of the New Bedford Gas Co., at New Bedford, Mass. The Roof on this building was furnished by us. The building is 32 feet in width by 50 feet in length, the Roof being made entirely of iron—that is, iron trusses and iron purlins covered with corrugated iron. The room is ventilated by a wrought iron ventilator extending the full length of the building, with corrugated shutters on each side opening and closing by cords from the floor.

Write for Illustrated Catalogue.

Office and Works, No. 6 Railroad Avenue, East Berlin, Conn.

HIGH CANDLE POWER
FROM
GAS.

MR. WALTON CLARK, Assistant General Superintendent, United Gas Improvement Co.:

Dear Sir—In accordance with your request, I have made several ests of the new Welsbach mantel (called No. 169) for candle power and efficiency, and I herewith submit the following results:

	Candle Power.	Pressure.	Gas Consumed.	C.P. per Cu. Ft.
Average of Test No. 1,	67.05	.95 in.	2.6	25.70
" " No. 2,	63.86	1.00 in.	2.86	22.30
" " No. 3,	72.50	2.1 in.	2.87	25.26

The above averages are the results of trials on three different occasions, and in each case the mantles tested were made from a different lot of fluid.

The mantles used in the above tests were selected at random, and all had been dipped in kristaline and dried ready for shipment.

It is quite possible that better results could have been obtained by manipulating and readjusting the position of the mantles on the galleries, and also by waiting a longer period after burning off the kristaline; but I considered such fine adjustment undesirable in determining the commercial candle power.

These tests were made on a bar photometer against a regular Edgerton standard slit. The candle power of the slit was 6.18, and the gas used was Gloucester City water gas, 26 candle power.

Very truly yours,
(Signed) C. H. PAGE, JR., M.E.

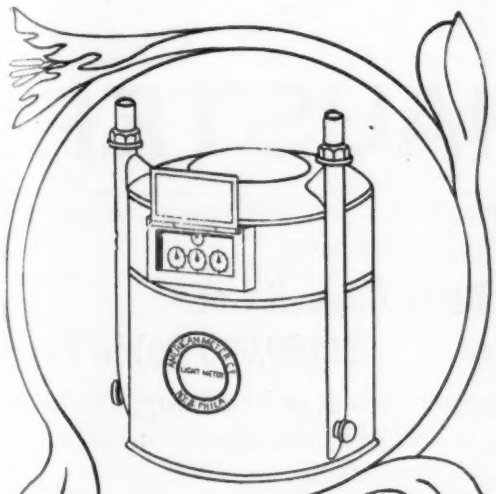
WE ARE NOW PREPARED TO FILL ALL ORDERS PROMPTLY FOR

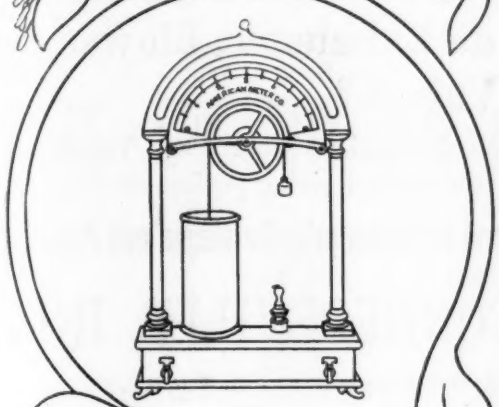
HIGH CANDLE POWER WELSBACH LIGHTS.

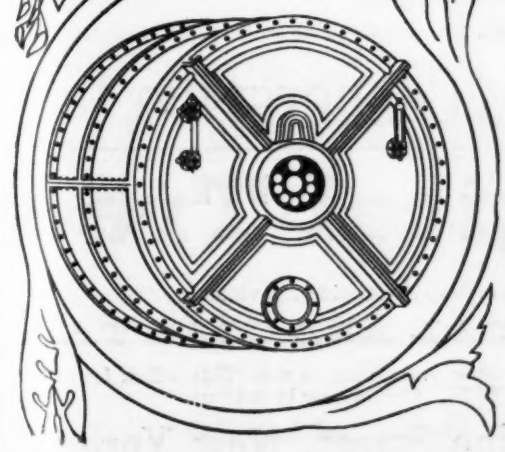
Gloucester, N. J. WELSBACH LIGHT CO.

NEWBIGGING'S HANDBOOK FOR GAS ENGINEERS AND MANAGERS.

The present (the fifth) edition marks an important advance on those that have gone before. Considerable additions have been made to the text and much of it has been rewritten and otherwise improved. Price, cloth, $6. A. M. CALLENDER & CO., 32 Pine St. N. Y.







AMERICAN METER CO.

ESTABLISHED 1834. INCORPORATED 1863.

NEW YORK and PHILADELPHIA.

CHICAGO, CINCINNATI,

ST. LOUIS, SAN FRANCISCO.

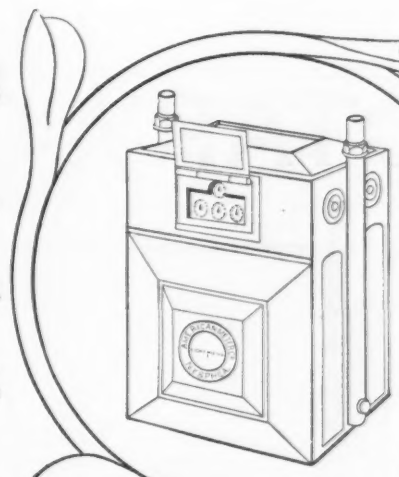
PUBLIC LIGHTING TABLE.

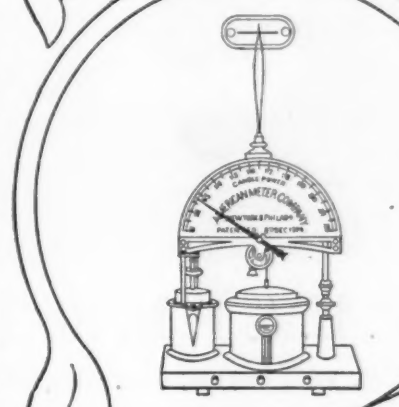
NOVEMBER, 1893.

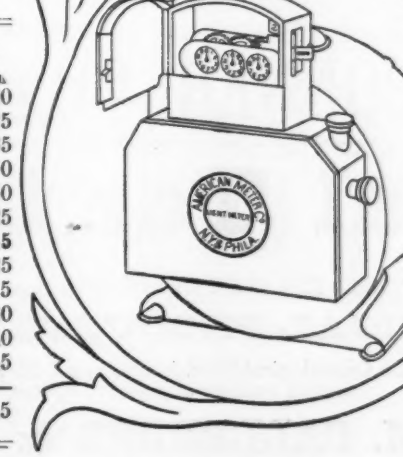
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Table No. 1. Following the Moon. Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Table No. 2. New York City. All Night Lighting. Extinguish.
				P.M.	A.M.
Wed.	1	5.30 PM	1.10 AM	4.45	5.35
Thu.	2	5.30	2.20	4.45	5.35
Fri.	3	5.30	3.30	4.45	5.35
Sat.	4	5.20	4.30	4.45	5.35
Sun.	5	5.20	5.40	4.40	5.45
Mon.	6	5.20	5.40	4.40	5.45
Tue.	7	5.20	5.40	4.40	5.45
Wed.	8	5.20 NM	5.40	4.40	5.45
Thu.	9	5.20	5.40	4.40	5.45
Fri.	10	5.20	5.40	4.40	5.45
Sat.	11	5.20	5.40	4.40	5.45
Sun.	12	5.20	5.40	4.30	6.00
Mon.	13	7.30	5.40	4.30	6.00
Tue.	14	8.30	5.50	4.30	6.00
Wed.	15	9.30	5.50	4.30	6.00
Thu.	16	10.40 FQ	5.50	4.30	6.00
Fri.	17	11.40	5.50	4.30	6.00
Sat.	18	12.50 AM	5.50	4.30	6.00
Sun.	19	2.00	5.50	4.25	6.00
Mon.	20	3.10	5.50	4.25	6.00
Tue.	21	4.30	5.50	4.25	6.00
Wed.	22	No L	No L.	4.25	6.00
Thu.	23	No L FM	No L.	4.25	6.00
Fri.	24	No L	No L.	4.25	6.00
Sat.	25	5.10 PM	7.20 PM	4.25	6.00
Sun.	26	5.10	8.30	4.20	6.10
Mon.	27	5.10	9.50	4.20	6.10
Tue.	28	5.10	11.00	4.20	6.10
Wed.	29	5.10	12.10 AM	4.20	6.10
Thu.	30	5.10 LQ	1.20	4.20	6.10

TOTAL HOURS LIGHTING DURING 1893.

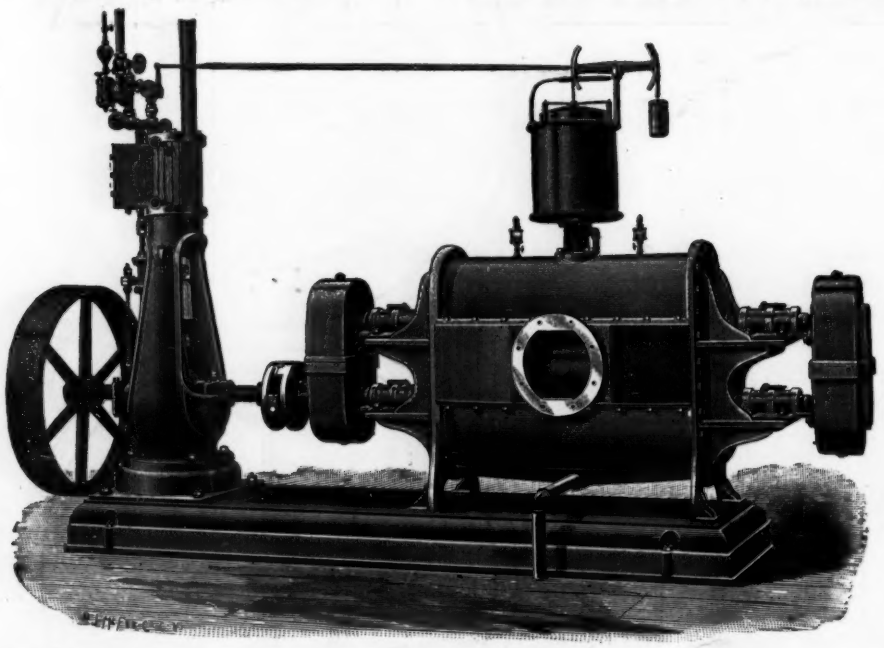
By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January...	217.30	January...	423.20
February..	200.30	February..	355.25
March	177.50	March	355.35
April.....	160.30	April.....	298.50
May.....	149.00	May.....	264.50
June.....	140.30	June.....	234.25
July.....	143.40	July.....	243.45
August....	154.50	August....	280.25
September.	171.50	September.	321.15
October....	202.20	October....	374.30
November.	221.30	November.	401.40
December.	248.50	December.	433.45
Total..	2188.50	Total..	3987.45







ROOTS' ROTARY GAS EXHAUSTER.



Our Exhausters sold from January 1st to August 1st have

A Daily Capacity of 31,160,000 Cubic Feet.

Our guarantee as to Durability, Efficiency, etc., is backed by our reputation and thirty years of experience.

Are You in the Market for an Exhauster, Blower or Valves?

If so, let us hear from you. Thousands now in use and giving perfect satisfaction.

Send for Descriptive Catalogue and Prices.

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S. S. TOWNSEND, Gen. Agt., COOKE & CO., Selling Agts., 163-165 Washington St., N. Y. City.

WE GUARANTEE

THE BEST DESIGNED, . .
THE BEST CONSTRUCTED,
THE SMOOTHEST RUNNING,
THE MOST ECONOMICAL, .
THE MOST EFFICIENT . .

GAS EXHAUSTER

NOW ON THE MARKET.

The attention of Gas Engineers and Manufacturers is respectfully invited to our new

CYCLOIDAL EXHAUSTER,

the internal operating parts of which consist of two Revolvers, each p'aned accurately on cycloidal lines, the only Exhauster so constructed.

SIMPLICITY * EFFICIENCY * DURABILITY.

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Coal Tar Genealogical Tree

MR. T. VINER CLARKE, of London, Eng., having compiled a novel Chart or Map illustrating the various

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In the form of a Genealogical Tree, including all the products discovered to date (the total number amounting to near 700), offers for sale a limited number of copies in Colors, mounted on Linen, with Rollers. Price, $3.50. Orders may be sent to

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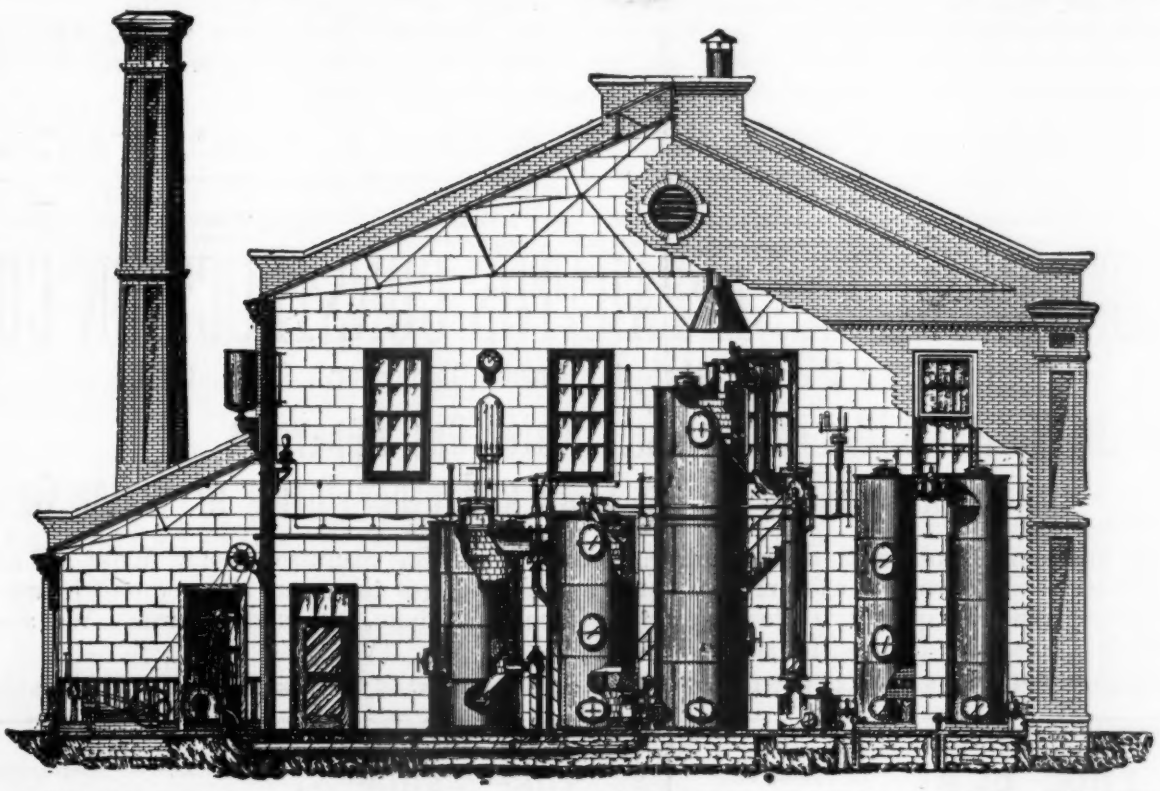
THE STANDARD LOWE WATER GAS APPARATUS.



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Water Gas Plants, either independent or auxiliary to Coal Gas Works, erected to meet any conditions. Apparatus designed to use any grade of Oil, and Anthracite Coal, or Gas House or Oven Coke.

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BY THE

WESTERN GAS CONSTRUCTION CO.,

Of Fort Wayne, Ind.

The number of Water Gas Plants built by us this year fully testify to the merit of our **Improved** style of **Lowe Water Gas Apparatus.** Results obtained in the various sizes of our plants, up to over 900,000 cubic feet capacity per diem, show what can be attained in a well designed machine. We are prepared to **Guarantee Results,** as well as first-class construction. We build apparatus ranging in capacity from 50,000 cubic feet to 1,000,000 cubic feet per diem, and larger when required.

Our shop facilities are unexcelled, and enable us to quote prices which will prove interesting. The plants in operation demonstrate we have the **Experience** necessary to build Water Gas Apparatus on **Scientific** as well as **Practical** principles, and consequently **Build them Well.** Hence we don't hesitate to **Guarantee the Results.** We not only believe in "Water Gas on its merits," but also in building the apparatus at a price that will not only prove it a desirable investment as to the first cost, but produce results that will put the balance on the right side of your ledger.

There are three essential features in our design which we carefully considered as **Absolute Requirements:**

Durability, neatness, and compactness of the machine.

Minimum labor requirements for operation, and

Minimum amount of material required for results.

And when we add to this a minimum cost of a **Strictly First-Class Apparatus,** can you afford to be without it? If not, write us, and we shall take pleasure in proving our statements to be facts.

Also remember we are not exclusively building Water Gas Apparatus, but if you require **Any Apparatus** for **Coal or Water Gas** and want the latest and best designs, write us for prices, or we will execute carefully your own designs if desired, as we believe in giving you exactly what you want.

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For Continuous Records of

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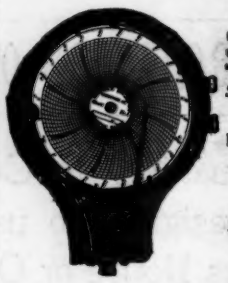

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See our Exhibit at World's Fair.
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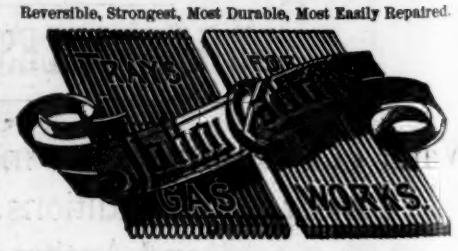
CHURCH'S TRAYS a Specialty.

Reversible, Strongest, Most Durable, Most Easily Repaired.



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OVER FOUR HUNDRED NOW IN USE! NO WORKS COMPLETE WITHOUT IT!
WILL PAY FOR ITSELF WITHIN A YEAR! ITS SERVICE SECURES PERFECT DISTRIBUTION!
REDUCES LEAKAGE TO MINIMUM, and BENEFITS THE COMPANY and CONSUMER ALIKE!
IT IS THE ONLY RECOGNIZED AUTOMATIC GOVERNOR IN THE WORLD!

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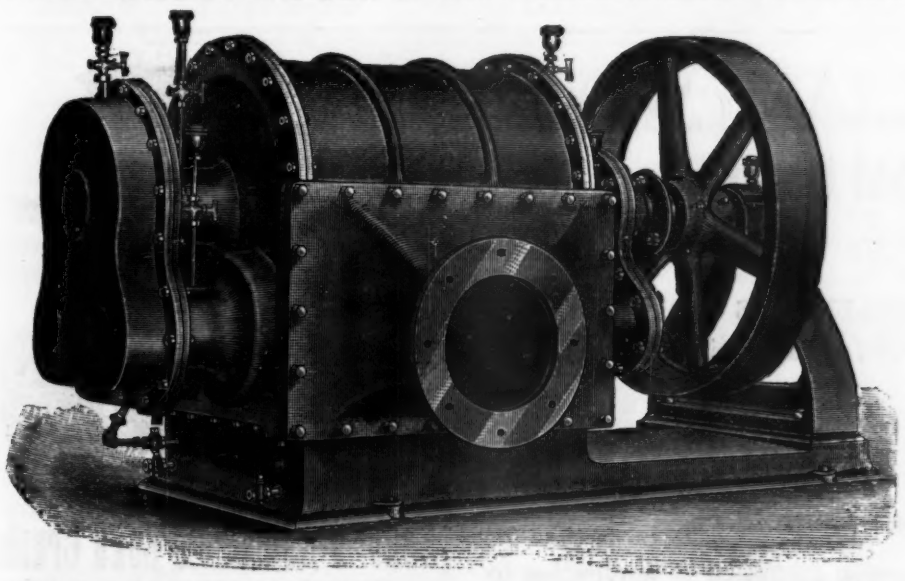

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For Gas Purification.

Acts immediately, and more efficiently than any other purifying agent now in use.

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DOUGLAS' FERRIC OXIDE

For Gas Purification

Is a superior natural Hydrated Oxide of Iron. Will give a higher purification per bushel than any other material. We ship the pure Oxide of Iron, containing no sawdust, thus effecting a saving in freight, leaving the consumer to furnish the diluent at a nominal cost. It is now used by the largest gas companies in the West.

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ALSO, SOLE SHIPPERS OF THE

Old Kentucky Shale, From Kentucky.

TRADE **O. K. SHALE.** MARK.

THE MOST VALUABLE GAS ENRICHER NOW AVAILABLE IN ANY DESIRED QUANTITY.

S. CALVERT FORD, Government Inspector at Washington, pronounces this Shale

"ONE OF THE BEST GAS ENRICHERS THAT HAS BEEN OFFERED TO THE TRADE."

He reports it as giving:

12,553 Cubic Feet of 50-Candle Gas,
or 10,460 Cubic Feet of 60-Candle Gas,

AN EQUIVALENT OF 627,650 CANDLE FEET,

And 808 Pounds of Merchantable Coke.

Single Carloads or more delivered at any required point in the United States or Canada.

Cargo Shipments from NEW YORK, PHILA., BALTIMORE and NEWPORT NEWS.

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Proprietors of the **BATHVILLE COLLIERIES** (which produce the celebrated **BOGHEAD CANNEL**), Shields, Shieldmuir, Drumpeller, and other Collieries. This Firm offer

STANDARD CANNELS,

Unequaled as Gas Enrichers.

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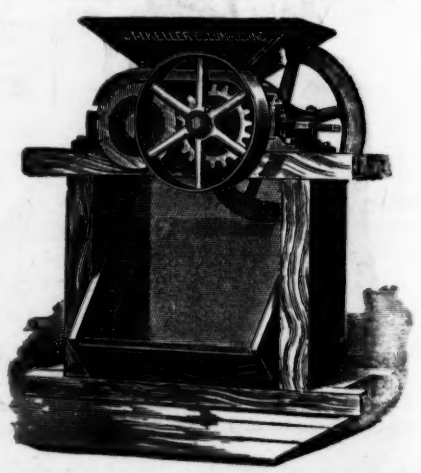

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SIMPLE, STRONG, AND DURABLE.

J. M. Keller, Sec. & Supt. Gas Lt. & Coke Co. Columbus, Ind

Correspondence Solicited.

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MINERS AND SHIPPERS OF

DESPARD GAS COAL,

AND MANUFACTURERS OF

COKE.

MINES, Clarksburg, Harrison Co., W. Va.
WHARVES, Locust Point, Baltimore, Md.
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Either for New Works or Extensions to Old Plants.

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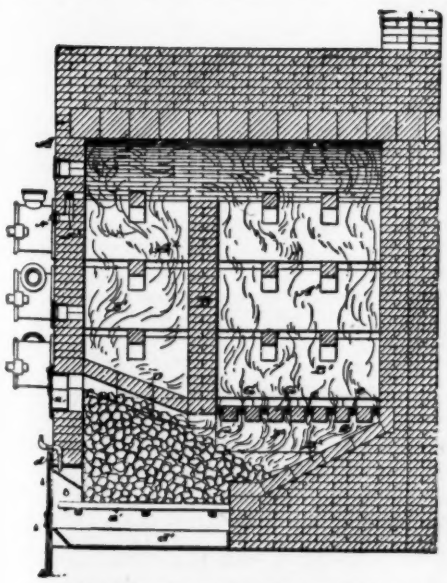

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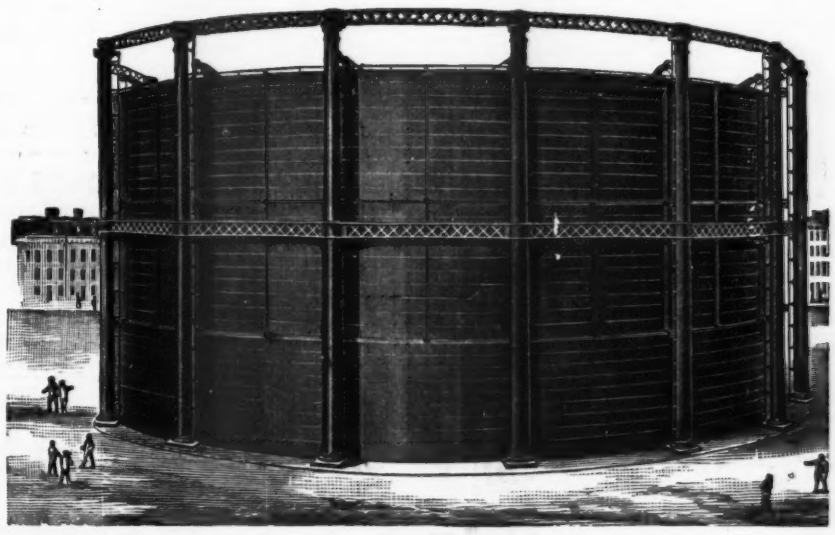

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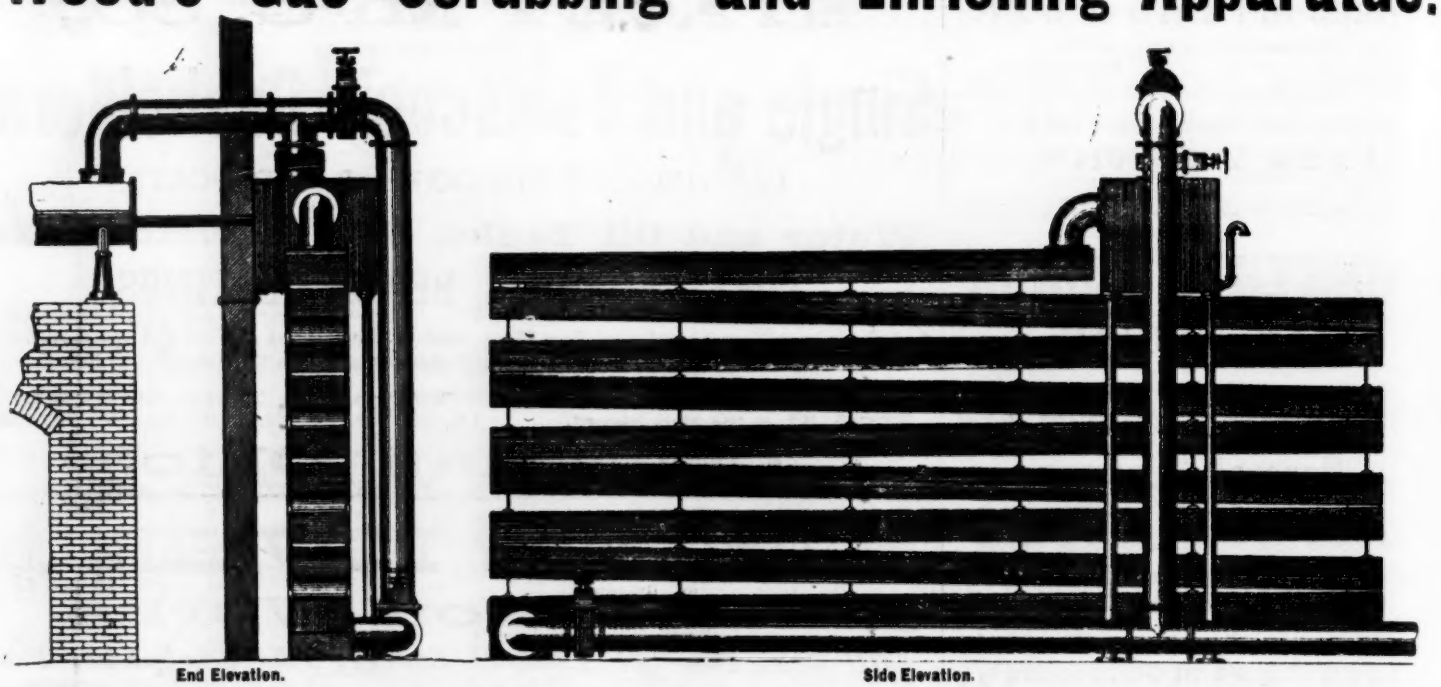

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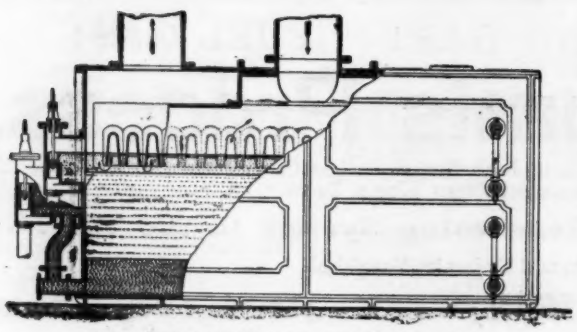

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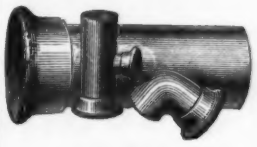

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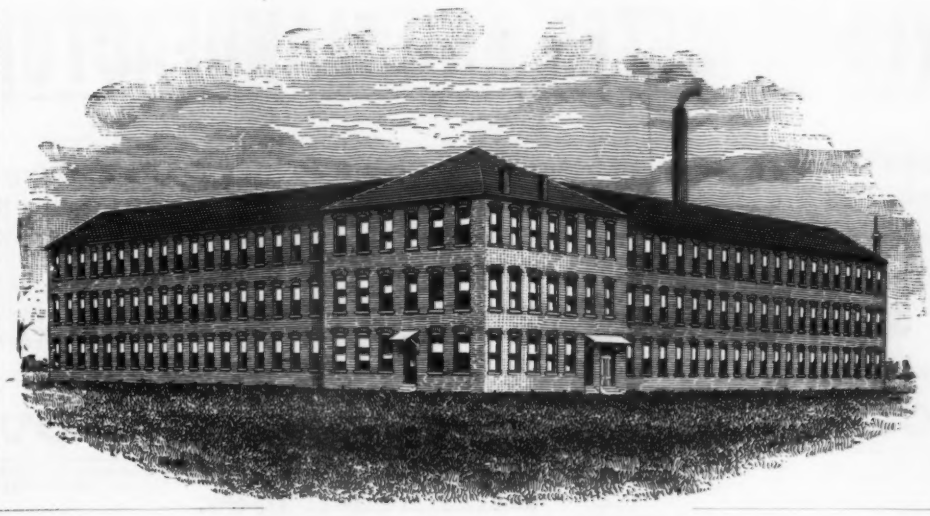

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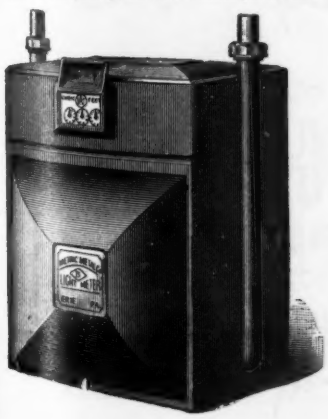

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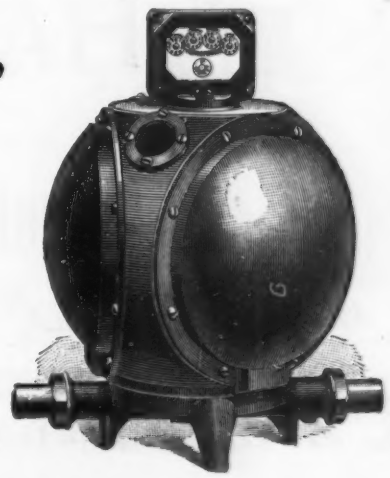

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Gas Cooking Stove No. 7C.

The Most Economical, Efficient, and Durable Gas Stove Made.

	SIZE.		
Stove.	*Oven.*	*Broiler.*	*Top.*
31 inches high.	9½ inches high.	10 inches high.	21 inches high.
17 inches wide.	15 inches wide.	15 inches wide.	16 inches wide.
	12½ inches deep.	12½ inches deep.	
	Length over extension shelves, 32 inches.		

This Stove has three Boiling Burners in the Top or Hot Plate, and single Oven Burner.

The consumption of this Stove is 35 cubic feet per hour, at 1¼ inch pressure with all burners.

Three-eighth inch supply pipe should be used when the pressure is 1¼ inches or over.

ALL FITTINGS ARE NICKEL PLATED.

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Pressure Gauges of all kinds, Pressure Registers, Pressure and Vacuum Registers, Pressure Indicators (sizes 4, 6 and 9 in.), King's Pressure & Vacuum Gauges.

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